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ENVIRONMENT VIEWS

VOLUME EIGHT
NUMBER SIX
SPRING 1986

SECOND CLASS MAIL REGISTRATION NUMBER 4405 EDMONTON



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MAR 25 1986

Drought

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Environment Views is published quarterly by Alberta Environment. Each issue deals with a specific topic from various viewpoints with the aim of increasing awareness of environmental issues among Albertans. *Environment Views* is directed by an independent board with representation from environmental groups, government and industry. The views expressed by the publication are not necessarily those of Alberta Environment.

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Cover Photo: Oldman River Aerial shot by Alberta Government. Photo of grasshopper and wheat by Lethbridge Herald.

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We can't win the war against drought with snow
capture or zero tillage, but the fight has to start somewhere.

Editor's Notebook



The week I finished editing the stories for this issue, I drove with the family to Pigeon Lake, just outside of Edmonton. Many of the fields were bare, although there were old snow drifts filling the roadside ditches. On top of the snow in many places was a distinct layer of dirt, black as coal dust.

Where had it come from? Why had it drifted from the plowed fields? Where was it going to end up? Was there enough to matter?

To answer the last question first, maybe not. After all, central and northern Alberta have been spared the worst of the drought of the past few years, which has hit hardest in the south. But lost soil is lost soil, and a source of concern even on a relatively small scale.

According to soil scientist John Timmermans, it is often the richest part of the soil that blows away in a windstorm. The all-important organic matter is in small particles, readily carried by the wind. In 1984, he says, 400,000 hectares of Alberta farmland were affected by wind erosion, for a loss conservatively estimated at 12 tonnes per hectare. That's approximately five million tonnes in one year. (see story p. 9)

The weather conditions in 1984 and 1985 were as bad as during the Thirties. A lot of southern Alberta farmers suffered hardships, but there weren't the massive duststorms and widespread bankruptcies of the Dirty Thirties. Why not? As writer Gillian Sniatynski learned, we know more about how to farm in drought country since then.

Researching *Environment Views* is seldom straightforward and occasionally turns up gems of wisdom or history. In Sniatynski's story, for example, we find out about an important connection between the Riel Rebellion of 1885 and the dust bowl years almost half a century later. (see story p.4)

Despite the improvements in the fortunes of dryland farmers made over the past few decades, there have been hard times again since 1982. Is there more that can be done? Norma Ramage and Linda Goyette explore the possibilities for further droughtproofing, including both large- and small-scale solutions. When are massive water projects justified? What can individual farmers do? (see stories p. 24 and 27)

Drought is not just an agricultural issue. Dry

years mean loss of important wildlife habitat, sometimes permanently. For example, a couple of bad years can dry up a marsh enough for a farmer to cultivate it, and once it's cultivated, it is not likely to be allowed to return to cattails. Waterfowl and game bird populations are down all over the prairies. Has it come to "us or them" in a competition for water, habitat — or grain?

And finally, what's next in Next Year Country? Drought prediction from year to year is an inexact science, and predicting the long-term effects of global warming (or cooling, depending on who you talk to) is even more poorly understood.

Maryhelen Vicars, a former journalist, is the freelance editor of *Environment Views*.

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Gillian Sniatynski

No More Dustbowls

Learning from the Dirty Thirties



Dick Middleton in a field on his drought-stricken farm, with almost no snow cover in January.

SUSAN BRUN

For farmer Dick Middleton, of Champion, Alberta, 1980 happened to be a bad year. But 1981 was a bumper crop.

"We were in such a good position to make a lot of money off that year," he said.

"We had a lot of winter wheat seeded, we gave it some extra nitrogen . . . We just cleaned up and had a heck of a year . . ."

"I started building a house, after 1981, thinking things were on their way again."

Instead what followed, for Middleton, his brother John, their partner Jim Saunderson, and farmers across the prairies, were three years of increasingly severe drought. It was not a good time to be building new houses.

"The last three years in this area have been low-yielding," says Leon Archibald, a Fort Macleod farmer.

"In the '84 season our crop was maybe a quarter what it should have been. In the past year there were thousands of acres we never even looked at, come harvest time.

"Crop insurance allowed us to exist."

Though the first signs appeared for farmers like Dick Middleton as early as 1982, the past two years have been disastrous for many prairie farmers and ranchers.

According to Dr. Barry Grace, an agricultural meteorologist at Agriculture Canada's Lethbridge research station, these were years of "severe drought" across southern Alberta and Saskatchewan.

Dryland crops dried up before they could be harvested. Some crops had such poor yields that they were left standing in the fields or used for forage.

Even farmers using irrigation had trouble keeping enough water on their fields, especially in 1984. (Grace notes that the Lethbridge Northern Irrigation District needed four general system shutdowns during the summer of 1984 — the most for any year since the district began operation in 1924.) Compounding these problems for many farmers were the severe infestations of grasshoppers.

Though the effects were the same for both

years of drought, the climatic patterns were quite different. Drought is hard to define, but experts agree that it involves much more than simply a shortage of precipitation.

The key factor is soil moisture. Grace points out that since crop growth normally removes all available moisture from the soil during each growing season, dryland farmers depend on fall and winter precipitation to ensure adequate soil moisture reserves at seeding time.

The 1983-84 fall and winter period was one of the driest on record — and above-normal temperatures were recorded in southern Alberta for January, February and March. The above-freezing temperatures, combined with high winds and low humidity, further depleted what little soil moisture reserves there were.

During the same period, snowpack conditions 48 to 61 per cent of normal boded ill for irrigation farmers depending on spring run-off. Everything pointed to the need for above-average spring rainfall to soak the soil

and top up irrigation supplies.

Instead, April, May and June precipitation was well below average, and soil moisture was largely gone by early summer — when cereal crops, especially, need large amounts of moisture for grain development. Summer rain was needed, and it didn't come.

"A total of 36 days without precipitation was recorded at Lethbridge from June 23 to July 28," says Grace.

Dryland crops failed, grasshopper populations increased, and there were problems with irrigation.

The rains did come, though, in the fall of 1984. There was also near-normal precipitation the following spring, and snowpack conditions in the mountains were average or better. Soil moisture conditions were good as farmers moved into the fields to prepare for the 1985 growing season.

But the good was soon gone. Summer rain, scanty in 1984, was almost non-existent in 1985. Only 2 millimetres fell in June, traditionally the wettest month of the year with an average of 73 millimetres.

"From mid-May to the end of July, no agriculturally significant precipitation was recorded at Lethbridge," Grace says.

"We were looking a little bit silly about the end of June, when we had told everybody the potential was there for a good crop."

People on irrigation *did* get some good crops. But many dryland crops failed again. The weather suited only the grasshoppers.

It's not just lack of rain, but the timing of the rainfall, that matters, Grace stresses. In the Lethbridge area, for example, the 1974 growing season was very dry, with only 52 per cent of normal rainfall. Yet crop yields were average or above average, because pre-

cipitation had been above normal the previous winter, and soil moisture reserves were well up.

Research by Dr. Keith Hage, who recently retired as professor of meteorology in the University of Alberta's geography department, confirms the need for taking a longer view in assessing drought.

Hage began by reading several hundred community histories, for Saskatchewan and Alberta (but particularly southern Alberta), and logging every mention of extreme weather. The dry year noted time after time was 1910.

He decided to compare the human record with the limited weather data available for the period. A comparison with growing season precipitation showed very poor correspondence. But when he added in precipitation for the preceding fall, and growing season temperatures (on the assumption that warm weather causes more soil moisture loss to evaporation), he too was left with the conclusion that 1910 was the worst drought since 1888, the start of his survey period.

*It's not just lack
of rain, but the
timing of the
rainfall, that
matters.*

Out of the combination of climatic data and community history, Hage developed a "drought index" which allowed him to evaluate the severity of a drought year, and hence make some comparisons. He found, for example, that 1918, 1919 and 1936 were also years of severe drought — though not as severe as the 1985 drought.

The comparison people *want* to make these days is between the droughts of the past two years and those of the 1930s. Comparisons are probably inevitable: the "Dirty Thirties" are still well within living memory, and there has been nothing since then against which we can measure the experiences of the past few years.

According to Hage's index and the available climatic data, the droughts of the past two years were at least as bad as those of the Thirties. Yet, as Barry Grace points out, the effects on agriculture were quite different.

It's further evidence of the fact that there is more to drought than lack of rainfall — and also, perhaps, that we really did learn something from those earlier experiences.

Charles ("Red") Gillett, of Moose Jaw, Saskatchewan, was working in southern Saskatchewan in the spring of 1936.

"The spring started not too badly," he recalls.

"There was moisture, and the crops seemed to have got a start. Then we hit into hot dry winds. In a matter of two or three days it went from green to burnt — and the dust was blowing."

Near Milk River, in southern Alberta, Steve Angyal was a boy helping on his father's farm during the '30s.

He remembers the crops being too short to be cut with the then-conventional binder. Then, too, farming depended heavily on



Thirties dust bowl conditions. Windblown topsoil drifted like snow.



GLENBOW ARCHIVES

This family was driven out by the '30s drought in southern Alberta, heading for a new start near Peace River.

horses — and the drought took its toll on them.

"We couldn't get the farming done properly because there was no feed for the horses," he remembers.

"So we worked them for half a day then

turned them out for what little grass there was."

Angyal remembers, too, the poverty of the '30s: peddling butter and eggs from door to door in the nearby town for extra cash; trap-

ping weasels, skunks and rabbits and selling their hides; using scrap lumber and cow chips for fuel, or loading a wagon of waste coal and rock from the "bone pile" of a nearby coal mine.

Bert Hargrave is a cattle rancher at Walsh, Alberta, 56 kilometres east of Medicine Hat. He was in his teens during the '30s, and has some vivid recollections.

"I can remember one incident in particular," he says.

"We were away where we run our cattle in the summer time, when one of those terrible dust storms appeared in the north-west skyline early in the evening.

"We really thought it was going to be a very welcome thunderstorm."

"There was no wind. But finally before it got to us we could hear the wind . . . As it got closer there were clouds rolling over and over. The dark color came from the dust."

"When it hit us — there had been lots of daylight, but it darkened up immediately."

The dust storms, the soil erosion — the "dust bowl" — are our most graphic images of the '30s. But the soil erosion problems, according to Grace, actually had their beginnings in the previous century.

It was the mid-1850s judgement of Captain John Palliser that most of the southern part

neer with the Prairie Farm Rehabilitation Administration in Calgary, believes strongly that such research could be extended to help predict droughts in southern Alberta.

It's not a matter, he feels, of trying to narrow down a huge global climate model, but of working in the opposite direction, of starting with a small area (like southern Alberta), where fewer variables are at work, and where weather can be shown to be linked to a few measurable factors. Chief of these, Nemanishen believes, is Pacific Ocean temperature.

"Even the people in California, who have helped us a lot, recognize that any drought impact is first of all felt in southern Alberta," he says.

"It is so vulnerable — so we must take a lead role."

If farmers knew a drought was coming, they could perhaps decide to seed winter instead of spring wheat. They could pump water to dugouts, and haul fodder for stock.

With crop losses estimated at \$500 million for each of the past two years, Nemanishen would like to see much more emphasis going to work on drought prediction.

A small drought forecasting institute in southern Alberta would, he feels, be a good start.

— Gillian Sniatynski

Predicting Drought Years

Take a cup of coffee, says Dr. Barry Grace, an agricultural meteorologist with Agriculture Canada's Lethbridge research station.

Now pour in a tiny bit of cream, and watch the swirls and eddies that form.

Grace says that's a good comparison with the earth's atmosphere, with the swirls and eddies representing storm systems. To forecast the weather accurately, he says, you have to watch where each little particle in those swirls and eddies is moving — in three dimensions.

It shows something of the complexity of weather systems, and the difficulty in forecasting even one day ahead. That difficulty is the reason why most meteorologists and climatologists are skeptical about the possibility of making accurate long-range predictions about drought.

"The general scientific community in Canada will agree that any longer than a few days for accurate prediction based on synoptic events is impossible," says Grace.

That's not to say it isn't desirable, and worth trying. Environment Canada, through the Canadian Climate Centre in Downsview, Ontario, is attempting on a trial

basis to produce weather forecasts for a month and for three months.

But "our batting average isn't very good," says Bill Pugsley, the centre's director of planning and scientific program development.

Even for the most general predictions (like whether temperatures will be normal, above normal or below normal) there's only an accuracy rate of 60 to 65 per cent. Precipitation predictions are only right 50 to 55 per cent of the time.

Pugsley says that even with the best available computer models, it's hard to work more than five or six days ahead. Over a large area and for a long time (for example, the prairies, a month ahead) the likelihood of accurate prediction would be "slightly better than chance, but not much."

Work is being done in the United States, however, on certain key determinants of weather systems. For example, Dr. Jerome Namias, a forecast specialist with the Scripps Institute of Oceanography in La Jolla, California, is studying the relationship between the atmosphere and ocean temperatures.

Walter Nemanishen, a planning engi-

Worst Yet to Come?



JOHN TIMMERMANS

A southern Alberta dust storm during the summer of 1985.

For anyone who has endured the effects of the 1984 and 1985 droughts, the big question is, how much worse can it get?

One factor affecting the answer is the global warming trend now popularly known as the "greenhouse effect".

The term is a misnomer, points out eminent Canadian climatologist Dr. Ken Hare, provost of Trinity College at the University of Toronto.

Carbon dioxide (CO₂), clouds, and water vapor, he says, act more like a blanket than a greenhouse, in retarding the return of the earth's warmth to space.

CO₂ levels in the atmosphere, mostly the result of combustion of hydrocarbons, are expected to double before the middle of the

next century. Earth will in effect be wrapped in a thicker blanket.

There is a lot of uncertainty surrounding predictions about the effects of increased CO₂. Not enough is known, for example, about the influence of the oceans as sinks for both CO₂ and heat, or of trees and plants that use CO₂ in photosynthesis. There is also speculation about a possible cooling trend as a consequence of volcanic activity. (The 1982 eruption of El Chichon in Mexico, for example, spurted a veil of volcanic dust into the stratosphere that may have had a slight cooling effect over most of the northern hemisphere.)

In spite of these unknowns, scientists remain sure that there will be some effect from increased CO₂ levels.

of Alberta and Saskatchewan was unfit for agriculture. And while the drought-prone "Palliser Triangle" did come to include some of the best wheat-growing land in the country, Palliser was correct in his assessment of some of the rest.

But both good and bad land was settled in the late 1800s and early 1900s following a more favorable account of the area by biologist John Macoun, and the active encouragement of the Canadian Pacific Railway and the then Dominion government. Settlers — most of them with no experience of dryland farming — poured in to take up land holdings that were often too small to be economically viable.

Other changes were also occurring in the environment. In a paper called "Drought in the Alberta perspective," Bruce Findlay of the Canadian Climate Centre in Downsview,

Ontario, cites the trapping of beavers (and the end of their water conservation work in the Cypress Hills), the destruction of the bison herds, the increased use of prairie fire by the Indians as a hunting tool, fires caused by European settlers, and the activity involved in building a railway.

"Given (these) complications . . . it is hardly surprising that considerable controversy existed regarding the semi-arid or sub-humid south prairie," he writes.

"What is clear is that drought frequency is favored by massive destruction of natural vegetation and habitat."

The other major development that was to lead to many of the soil erosion problems of the '30s was the practice of summerfallowing, or leaving uncultivated a portion of farm land each summer.

"We have established with reasonable confidence that temperatures are going up, and we have got numbers for that, that are accepted internationally," says Bill Pugsley, director of planning and scientific program development with the Canadian Climate Centre in Downsview, Ontario.

Temperature increases are likely to be biggest at the Poles and smallest at the equator. Between 40 and 60 degrees of latitude (of special interest to Canadians) increases of about 3.5 degrees Celsius are expected.

What this means for people on the prairies is very hard to say. Warmer weather might mean a longer growing season — a plus. But it might also mean earlier, and diminished snowmelt — a minus. Unless warmer temperatures are accompanied by increased precipitation, the chances of drought on the prairies are greatly increased.

Into the uncertainty, Dr. John Maybank, director of the Saskatchewan Research Council's environmental division, injects an optimistic note.

Maybank points out that most of the climatic models ignore the biological effect of enhanced CO₂ levels on plants. He cites recent research to show that with extra CO₂, most plants yield more abundantly and may actually need less water.

"These features completely overwhelm any of the potentially negative effects that have been pointed out in some of the climatic models," he says.

Hare points out that Colorado, Nebraska, South Dakota and to some extent western Iowa now have the sort of climate being predicted for the Canadian prairies. So a study of their agricultural practices might be helpful.

"The worst possible way to approach a problem of this kind is to say 'Woe is me' and try to stop it from happening," he says.

— Gillian Sniatynski

The advantages were discovered by an accident of history in 1885. Farm horses were conscripted from the community of Indian Head, Saskatchewan, to haul supplies for the army that was suppressing the Riel Rebellion. When the horses were returned, it was too late for their owners to plant a crop. So the land was worked during the summer, then left fallow. The following year, the same land produced excellent crops, despite an almost complete crop failure everywhere else.

This so intrigued the first superintendent of the Dominion experimental station at Indian Head that he launched a series of experiments with summerfallow. According to Grace this led to the system of summerfallowing that was to turn the Palliser Triangle into the sometime "bread basket of the world."

Leaving land fallow conserves its soil mois-

ture — provided the land is worked to prevent weeds from using the moisture instead.

As late as 1930, it was considered good farming practice to work fallow land often, to maintain a "dust mulch" on the surface. In fact the constant tillage pulverized the soil into a fine powder that was easily carried off by the wind when the dry years arrived.

The soil began to blow from parched summerfallow during 1929. Each year the desert expanded until by 1937 the entire Palliser Triangle — more than seven million hectares — was threatened.

The crisis was averted by a handful of people — like Dr. Asael Palmer, of Lethbridge, who promoted trash-cover fallowing; C.S. Noble, who developed a plow to reduce

or tree planting was taken permanently out of production and turned gradually into community pasture.

Water conservation was a top priority. Within six years, PFRA had designed and subsidized the construction of 14,000 dugouts on individual farms. Later, the emphasis was turned to larger water projects on the scale of the Gardiner Dam in Saskatchewan and the St. Mary Irrigation Project in southern Alberta. Today, says a PFRA publication, "our objectives remain much the same as they were in 1935, and many of our original programs for soil and water conservation and development continue to this day."

Efforts like all of these represent the lessons learned from the '30s. Because the les-

might have made our crop (last) year."

Some highly practical research is also being done by the farmers and ranchers themselves.

Leon Archibald at Fort Macleod is experimenting with the timing of seeding and spraying for most effective grasshopper control. (And he's noticed also that they seem less keen on Durham wheat!)

Going into the winter, Bert Hargrave has been reducing the size of his herd, to meet the carrying capacity of his short-grass winter grazing. That way, he doesn't have to buy feed. And working at ways to conserve natural water supplies on rangeland (especially snow runoff) continues to be a priority.

Dick Middleton at Champion is changing his emphasis from crops to cattle, and trying rotational grazing as a means of increasing the carrying capacity of his pasture.

People like these are hanging on, and hoping fervently that this year will be better.

"If we come out of this," says Middleton, "it will have been a tremendous learning experience."

Gillian Sniatynski is a freelance writer and editor living in Drayton Valley.



TOM JENSEN

Summerfallow still has advocates, but many agriculturalists blame the practice for wind erosion during dry years.

soil disturbance while cultivating; and Dr. Lawrence Kirk at the University of Saskatchewan, who developed Fairway crested wheatgrass to stabilize drifting areas.

In 1935, the Prairie Farm Rehabilitation Administration (PFRA) was formed to "secure the rehabilitation of the drought and soil drifting areas in the Provinces of Manitoba, Saskatchewan and Alberta and to develop and promote within those areas systems of farm practice, tree culture and water supply that will afford greater economic security."

PFRA staff in the early years worked closely with the Dominion experimental farms, and organized more than 200 Agricultural Improvement Associations, to help demonstrate and promote such new techniques as soil ridging, strip cropping, and retaining stubble to prevent soil drifting.

Within a few years, six million trees had been planted, to form more than 1,000 kilometres of shelterbelt. Land that couldn't be saved by the use of new farming methods

sons were learned (and because of extra support for farmers through such programs as crop insurance) the impact of drought in this decade will not be clearly so devastating.

That's not to say there's nothing more to learn.

Bare summerfallow was the prime cause of the soil drifting of the '30s. Today it's also known that summerfallowing causes salinity and organic matter loss. Innovative methods like continuous cropping and zero tillage are among those being studied by PFRA's soil conservation planning section, established in 1981.

Lethbridge Research Station's Barry Grace is studying the microclimate of the top few centimetres of soil and the first metre of air, in relation to various tillage practices.

Research like this may not have the dramatic impact of, say, the introduction of the Noble plow. But, notes Grace, "each new step adds a tiny bit."

"Another inch of moisture in the ground

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Alberta's environment?

Sharon Adams

Blowing in the Wind

Drought's impact on soil



Dust storms rolled across the prairies during the '30s, carrying the best topsoil away.

The date was marked on the calendar: Dec. 18, 1984. The date Fred Haz's winter wheat was sacrificed to save his eroding soil.

"It's a sickening feeling to see the soil blowing away," he says. "The ground was frozen and there was no implement on my farm that could do anything about it."

"I just couldn't stand it." So he called the County of Lethbridge to bring a road grader to rip up the field, bringing moist lumps of soil to the surface to stop the wind from blowing away more topsoil.

"It was better to lose the crop than the soil."

Haz understands that the value of land begins with the soil.

The building blocks of soil fertility are found in what soil scientists call biomass — both decayed remains of and the living roots of plants plus bacteria, fungi, worms and insects living in the soil. This provides the soil's nutrients and improves soil structure, called tilth, to make rooting easier.

But drought and its deadly companions wind and water erosion cause the depletion of biomass and consequent degradation of the soil.

Moisture, temperature and biological activity determine the soil characteristics of

"In a drought year, one bad thunderstorm can do a great deal of damage."

Alberta's six broad soil categories: Brown, Dark Brown, Thin Black, Dark Gray, Dark Gray Wooded and problem soils — solonetzic, salinic and acidic.

Only about 11 million of Alberta's 64 million hectares are under cultivation. Of that, 4.3 million hectares — stretching in an 80-kilometre band through Alberta's agricultural heartland from east of Edmonton to Brooks, as well as in isolated pockets — is solonetzic.

Solonetzic soils are characterized by hardpan, an impermeable subsurface which defies penetration by roots and water below the topsoil.

Since neither moisture nor roots go deep, "the crops frequently depend on the topsoil for moisture and nutrients," says Dr. Bill McGill, chairman of the University of Alberta's soil science department. In drought years, there's not much of either.

It's a vicious circle in drought-sensitive soils: Less moisture, less growth; less growth, less root mass; less root mass, less biological

activity and fewer plants, less cover; less cover, less moisture . . .

In the south, effects of a summer drought can be exacerbated by winter. Northern Alberta's snow cover is generally good even in dry years but in the south, warm winter chinook winds can spell disaster. Freezing, then thawing, soil loses moisture through sublimation, says Dr. John Dormaar, a research scientist with Agriculture Canada, "leaving the soil in a powdery condition."

Without stubble, or with reduced cover, farmers like Haz may end up watching their topsoil blowing in the wind.

But McGill, says it's hard to generalize about the province as a whole.

A short-term drought, McGill says, poses less risk to soil than poor farming practices. "The important five per cent of the soil is the biologically active part. It's inconceivable you'd lose it all in two years through drought. If it persisted for 10 years, then you'd have a problem."

But even a short drought increases chances of erosion. "In a drought year, one bad thunderstorm can do a great deal of damage," says McGill.

"If erosion takes place on solonchic soils," says McGill, "losing a little topsoil has a bigger proportional effect" since the plants depend so heavily on topsoil for nutrients and moisture. Though Gray Wooded soils have a similar problem — a subsurface unfavorable to root penetration — they tend not to be in drought-prone areas.

A farmer of drought-sensitive soil affected by wind erosion is served a double-whammy: less topsoil, and topsoil that is less productive, says John Timmermans, soil salinity and conservation specialist for Alberta Agriculture in Airdrie.

"What you see blowing here," he said, indicating a blackened sky on a windy January day, "is the best part of the soil." What is lost in wind erosion is richer than what stays because the organic matter is in small particles, readily carried by the wind. In addition, he says, farmers of this eroding soil may have treated the fields in the fall. If so, now they'd also be losing the investment in chemicals, too.

The economic impact of erosion, Timmermans says, can be staggering. Erosion of 2.5 cm of topsoil from one hectare of Dark Brown soil removes about 160 tonnes of soil and enough total nitrogen and phosphorus to produce nearly 1,235 bushels per hectare of wheat. "And the next year, the farmer is starting without those nutrients."

Changes in soil fertility and physical structure affect crop yields — up to 12 bushels per hectare of wheat per year for each 2.5 centimetres of eroded topsoil. Normal yields in Alberta are 30-35 bushels per hectare. One experiment conducted at the Agriculture Canada Research Centre at Lethbridge found



Bill McGill

"Fertilizers don't put the fibre back into the soil."

net returns on 16 crops from land on which 20 centimetres of topsoil had been removed were \$140/hectare less than undisturbed soils (in 1985 dollars).

A soil's sensitivity to wind erosion is determined by a number of factors: soil texture, the amount of organic material, amount of moisture and wind velocity.

In 1984, 400,000 hectares were affected by wind erosion, says Timmermans. "Assuming erosion at 12 tonnes per hectare, that's a conservative estimate of soil loss of approximately five million tonnes of wind-eroded topsoil."

"You can compensate with commercial fertilizers," says farmer Fred Haz, but with the topsoil blown off, you'll have to use more fertilizer and still won't produce the same healthy-looking crops. Fertilizers don't put the fibre back into the soil."

Compensation for soil degradation by fertilization contributes to farmers' lack of recognition of the problem, says Timmermans.

"We've had really tremendous increases in yield because of technology. Fertilizers, herbicides and crop varieties have increased yields, despite the deterioration in soil quality. Eventually we're going to have to pay the piper because technology can't continue to lift production to keep farms economic once the soil quality is depleted."

Yet because of technology, "A farmer may not notice his loss in the next year, because year to year variability can be so great," he says.

Degradation of the soil isn't a new problem in Alberta. Dr. Wayne Pettapiece, head of Agriculture Canada's Alberta Soil Survey Section, estimates as much as 50 per cent of Alberta's soils have been affected by erosion. Erosion in the '30s took nearly 50 cm of topsoil in some areas, soil that has never fully recovered.



So much topsoil has blown away from this field the gravel is left exposed on the surface.

FRED KATZ

JOHN TIMMERMANS



John Timmermans

"Erosion is essentially a problem of lack of cover," he says. "It's just as true for water as wind. Drought increases the possibility of erosion dramatically." Uncovered or exposed soil can be eroded by spring melt, a quick thaw or sudden thunderstorm.

Some areas, like the Milk River Ridge, have lost as much as five to eight per cent of soil through water erosion, "more than the proportion affected by salinization." Like wind erosion, water erosion reduces growth potential, and consequently, cover.

And as with wind erosion, water-eroded fields lose nutrients. Though it's possible to

start the slow rebuilding process. Pettapiece says, "once recultivated, some have reduced yields in excess of 50 per cent."

And rebuilding the soil can be a lengthy process. Dust bowl survivors are now reaping better crops than they did 20 years ago, he says, but they had hard years in the '40s and '50s.

The key is to get organic material — biomass — back into the soil. That's done by "growing lots and lots of crops."

The effect of erosion is hard to measure, especially since we have no bench mark from the time before cultivation started.

"We do have concerns with degradation of soils in drier times," says Pettapiece. Moisture increased during the '70s and consequently farming expanded, and farmers became less conscious of moisture-saving techniques. After the '84-'85 drought, the farming has contracted again — but not before some erosion damage.

Haz says his one winter wheat experiment taught him the dry times lesson. The Haz family has owned a farm 1.2 km southeast of Coaldale since 1940. He says none of the soil will blow off his half section this winter "because I have no open fields this year. In the past number of years we've had very little wind, and people took more chances. Now (after the last drought experience) they're prepared."

But Pettapiece worries the lessons of the past may be forgotten, and he's especially concerned about a proposal to sell some of the 2.1 million hectares of the Special Areas, Alberta's "dust bowl" of the Dirty Thirties.

In the '20s, the Special Areas were made up of 37 separate municipalities populated with 26,000 people. Overpopulated and overcultivated, by 1931 more than 6,000 farms in the area were abandoned. Today just 6,042 Albertans live there.



Wayne Pettapiece

The Special Areas Act of 1938 set up a board to rehabilitate and control use of the land, which was classified, regrassed, then leased out for grazing and cultivation.

Abner Grover, chairman of the Special Areas Board, says the Special Areas are successful. "Very little land is subject to erosion and I don't think we suffered from the '84 drought as much as other areas." This is due, he says, to farming practices, conservation techniques and better winter snow cover.

Another indication of the board's success, he says is "the number of long-time residents here. The leases are being taken over by a new generation in the same family." Good dryland farming and grazing practices are passed from generation to generation. Since the '30s, residents "have become aware of how to live with this land," 70 per cent of which was leased, and eight per cent of which is cultivated.

In 1981, the province decided to sell some of the Special Areas land to lessees. Outsiders will have to lease for 10 years before being allowed to buy.

"We will not sell very sensitive lands and we've placed caveats" on lands prone to wind or water erosion to prevent cultivation. These caveats go with the title from one owner to the next, protecting sensitive land in perpetuity.

Protecting the land is part of the farmers' job, too, say Haz. "It takes a lot of work and effort to keep the moisture in the field."



Drifted topsoil during the summer of 1985.

Viewpoint

In Africa, drought hits hard at farmers already caught in the cost/price squeeze.

Neil White

One morning last spring I decided to see how the hay crop was doing. A short walk brought me to the border of the field, and then it hit me in the face — a grasshopper, that is. Grasshoppers are unheard of in this area generally, but the dryness of the past 12 months brought an unprecedented scourge to this region of central Alberta. Bad news, too, has a way of slapping us in the face, whether it is a local event or news of drought, flood or earthquake elsewhere on the globe.

The impact of my little airborne adversary was just enough to startle me into realizing the issue of drought was touching home and affecting me right where I was standing, though I realized that my family, my farm, and even my more severely-affected southern Alberta counterparts were not suffering anywhere near the destitution felt by those who rise each morning to survey a parched and barren Africa. The fact is: in Alberta, drought may hit us in the face; in the African sub-Sahara, it kills.

Victims of Inequality

Famine and other "disasters" by definition cause destruction of property and death. Though we often reach into our wallets in international response, we also reach into our heads to pull out quick explanations. "Why do people live in such hostile environments?" we ask. "Overpopulation", "Corrupt governments", we cry in frustration and indignation. Yet nagging in the further reaches of our minds is the knowledge that these catastrophes usually happen in the poor countries. When the facts are uncovered from the material and human debris of these disasters a disturbing pattern emerges.

A range of disasters serve here as examples.

DROUGHT — Both the United States and Australia were severely affected in 1983. Farmers went broke. Bush fires killed 60 people in Australia, but no one starved. Estimated for the Sudan, Ethiopia and Chad in 1984 and 1985 were 14 million hungry, 1.5 million dead, and 1 million refugees.

VOLCANO — Mount St. Helens caused 60 deaths in May 1980. Columbia's "Nevado de

Ruiz" volcano erupted in November 1985 with similar ferocity, killing 20,000.

EARTHQUAKE — In 1971, San Fernando California experienced an earthquake which killed 65 people. One year later, a weaker quake struck Nicaragua, killing 5,000.

Freaks of nature do not happen more often or with greater intensity in the Third World. The "disturbing pattern" is that disasters tend to afflict the poor and weak people of poorer and weaker nations. Protecting those in wealthier countries are better homes, roads and food supplies as well as systems of education, health services, insurance, credit and communication.

Examine Famine

Drought doesn't happen overnight. Therefore it is even more merciless than other disasters in its ability to select its victims. The first rain failure of the current drought in Africa was in 1980. But we cannot blame the deaths of its victims entirely on the lack of rain. Sub-Saharan drought is not as much a lack of rain as it is an inability to absorb and retain the moisture it gets. And the land can't keep moisture when it doesn't have any soil.

*Privilege for a few
and the rest fend for
themselves.*

Even when the drought of 1968 - 1973 hit the African Sahel there was more soil in that region than there is today. Satellite pictures tell us today what Hamade, a peasant farmer in northern Burkino Faso could have told us years ago. The soil was going — with the rains in the wet season or the wind when it was dry.



Farm families all around him with their small plots knew that they would have to push their feeble soils to the limit, or starve. There's not enough grain in the granary to last until harvest. This is the malaise of Africa. The local people know when they are over-cultivating, over-grazing, and de-foresting, yet few other options exist.

Facing these situations, family spirit and pride may eventually break. They leave and become urban or camp refugees. Some get violent. Still others choose to leave for work on cash crop plantations or export mines long distances away to gain enough wages to tide the family over. And in this we find our clue to the essential problem in African nations (except South Africa with her own peculiarities). Whenever Africa needs cash it has to go elsewhere. National economies for the most part rely solely on foreign owned and controlled investment. Profit-making agendas set years ago in the colonial era are maintained today for outside interests by governments acting as *de facto* managers. Though not all elected officials can be charged with complicity in this "foreign exchange drain", a post-colonial inability to return to local control and self-reliance is Africa's most pressing disaster. Greed, indifference, and neglect have entrenched on the continent a pattern which reserves privilege for a few and leaves the balance to fend for themselves. Deprived of education, medical and community services, of capital and extension facilities, rural Africa is caught in a web of poverty and war. Help from abroad, whether government, volunteer

agency, or business sector, has had difficulty in effectively combating the growing poverty in Africa. Only recently are the causes of poverty and famine, not simply its symptoms, being treated. Drought has only triggered famine — the roots of the problem go much deeper into this continent's impoverished soil.

From Drought to Dignity

Farm analysts and others across the prairies maintain that the farmers who most loudly champion the case for local drought assistance are not in trouble because of drought but because they are caught in the food production cost/price squeeze. Whether on the Canadian prairies or in Africa's threatened farm land the challenge is the same: finding the sources of the crisis and working on them. Future security depends not only on this task, but in acting with common sense on those findings.

Hamade, his wife, and many of their Alberta farm comrades know what is good for their land but remain frustrated by their inability to exercise those preferential options. Though some land in under-developed countries may never be reclaimed, awareness building, organizing appropriate projects and self-reliance are all very obtainable goals. New initiatives favor investment in people, not in expensive capital projects. "Integrated rural development" which supports the full spectrum of needs is now replacing the former "shot-gun approach" to assistance. Wealthier nations are learning that money alone is not enough. Sensitivity arising from education here has produced better channels for that financial assistance. Such help will rebuild the dignity of this disaster's victims, and in so doing, will rebuild the ground on which they stand.

Drought in Alberta was at most the tale of a number of farm bankruptcies; in Africa, it

Money alone is not enough.

is a heavy book about environmental bankruptcy. In both settings local people must respond with common sense that mobilizes local resources and steers support from a broader base.

Neil White of the One World Institute in Camrose is co-ordinator of a grant program which works with Alberta volunteer groups to fund Third World projects, and also co-ordinates the international development education programs of local churches

Letters

Dear Editor:

The Winter 1986 issue of *Environment Views* contained the most interesting and informative articles that I have read for some time. Alberta's Natural Treasures are obviously undervalued by many of us and in too many cases are not recognized for their importance to our well being.

As I was reading these articles, I realized how little I know about the natural areas near my own home town. It also dawned on me that when we are doing our Land Use Planning and preparing our General Municipal Plans, we neglect to give consideration to the preservation of natural areas within our own communities.

I will be passing this issue on to both our Development Officer and our Recreation Services Manager, so that they might also become more aware of the need to protect and preserve more of our natural areas.

Yours truly,
A.W. Weinhandl, L.G.A.
Town Manager

Dear Editor,

I really enjoy your "*Environment Views*!" My husband and son also read it. The last issue is particularly interesting and will be read from cover to cover in this household.

I wish you and your staff and all your contributors continued success.

Thank you,
Amelia M. Pal
Calgary

Dear Editor,

I have just completed reading your "Alberta's Natural Treasures" issue. Very interesting. I have a few comments. First, on page 9 you state that the Yucca plant is found in the Milk River Canyon. According to "Wild Flowers of Alberta" by R.G.H. Cormack the Yucca plant is found south of Manyberries, which everyone knows is east of the Milk River.

On page 16, mention is made that Red Deer's Waskasoo Park was funded from the Urban Parks Program and that Lethbridge also received funding. I might add here that these are not the only parks funded for urban parks, Lloydminster, Grande Prairie and Medicine Hat are also included. Not being too familiar with the other parks, I am sure that all of the City Urban Parks developed over the past 6 years are the same as Medicine Hat's. These parks were developed for the preservation of some of the most interesting

and beautiful river valleys in the province. Perhaps *Environment Views* could do a story on all of the Urban Parks Programs in Alberta.

All-in-all, you have a very interesting publication. I enjoy it immensely.

Cliff Dacre
Redcliff

Dear Editor,

Please continue my subscription to *Environment Views*. I am a writer on environmental, ecological, and outdoor topics, and find the publication most enlightening and useful. I have carried out a good deal of ecological research in Canada, and find this is a valuable ally in my effort to keep up with current events in Western regions of the country.

I find your continuing interest in environmental affairs and events most encouraging. Only a long-term effort on the part of ecologists and environmentalists will have sufficient impact to ensure some enduring environmental policies and programs.

Keep it up.

Please note the change of address.

Sincerely,
James A. Larsen
Rhineland, Wisconsin

Dear Editor:

We've enjoyed reading "Winter 1986 *Environment Views*" and, while doing so, recalling our own discovery of points of special interest and places of (sometimes fragile) beauty or concern in this so varied a province.

Arousing and stimulating interest in the environment is essential to its preservation. We wish you all continued success in that effort and look forward to spring and the next issue of *E.V.*

Roy and Nellie Peterson
Mayerthorpe

Dear Editor:

I have just read the latest edition of "*Environment Views*" and it made me proud all over again to be living in such a beautiful province. I did not realize that there was so much variety of environment in our province. We plan on doing a lot of travelling and camping when my husband and I retire in two years.

We must congratulate you for a very informative and interesting magazine.

Yours truly
Mrs. Y. Dumont
Edmonton

Hazel Sangster

Drought and Pests

"Then the grasshoppers moved in to finish off what was left."



Like a Biblical plague of locusts, the grasshoppers moved across southern Alberta during 1984 and '85.

In Alberta in 1985 grasshoppers destroyed approximately 700,000 hectares of crops, and cutworms accounted for 92,000 hectares, adding up to lost crop and insecticide costs of \$33.6 million.

"'84 and '85 were real bad years. What the drought didn't take, the grasshoppers did," is how farmer Glen Roemmele, who farms east of Claresholm, sums up the past two years.

Marvin Prusky, who farms in the same area called it "a no-win situation. The only winners were the chemical companies." His problems started early in May 1985 with cutworms in his winter wheat.

"And later that month the grasshoppers moved in to finish off what was left. I had just finished spraying a field and stopped at an intersection on my way home, just north of my land; I couldn't even see the gravel for the hoppers crossing the road into my newly sprayed field.

Prusky feels that there is very little the individual farmer can do.

"Right now the only answer is to let the cycle run its course; once this dry cycle is over, then the grasshopper/cutworm problem will correct itself."



Glen Roemmele

Prairie conditions are cyclic and there is a direct link between dry conditions and pest infestations. Dr. Dan Johnson is an insect eco-

logist in the Crop Entomology section Agriculture Canada's Lethbridge Research Station. He has done an analysis of grasshopper infestation with relation to the weather back to the 1930s.

"A good, long, open fall with dry warm weather, as we had in '83 and '84, encourages the laying of eggs; and a warm, dry spring improves the survival rate of young grasshoppers."

In these conditions each grasshopper may lay 100 or more pods, each containing from 20 to 100 eggs. The pods are deposited primarily in soil next to crops, for example, ditches, banks, roadsides, dry sloughs. The eggs hatch into small, wingless nymphs, usually between mid-May and the first week of June (or earlier in a warm spring). They grow rapidly under hot, dry conditions and may reach the adult flying stage within five weeks.

Michael Dolinski, the provincial entomologist with the crop protection division of Alberta Agriculture, says that "even with a high egg count, a wet spring can lower the grasshopper infestation, as it did in 1973, '74 and '75.

"... Dry conditions not only promote the

breeding and survival of grasshoppers. They also mean weaker, smaller plants which cannot complete with a major attack by grasshoppers or cutworms."

Dr. Bob Byers is a crop entomologist with the Lethbridge Research Station.

"The Pale Western Cutworm, which is the problem at the moment, only flourishes in dry conditions, particularly dry spring weather."



Dan Johnson

The cutworm moths lay their eggs just below the surface of the soil in the fall; these eggs hatch underground between March and May. Spring precipitation is the critical factor in the increases and decreases of the cutworm population. Too much rainfall in the spring forces the cutworms to the surface where they fall prey to parasites and predators, and very dry conditions result in a decreased food supply and subsequent cutworm casualties.

Recent technological advances and increased agricultural activity also contribute to these infestations. Johnson has noted that "the five current common species of grasshoppers were far less common before the advent of agriculture. These insects favor weedy, disturbed vegetation, in other words, tilled land."

Both Johnson and Byers recommend certain cultural controls to reduce and control grasshopper and cutworm populations. The cutworm likes to lay its eggs in loose, powdery soil. If the land is left uncultivated and undisturbed from the beginning of August to mid-September, it forms a crust through which the moths cannot break to lay their eggs. Similarly, in spring, if the land is kept weed

free, the young cutworms should starve.

Both Dale Morrison and Larry Norris found that this latter method of control did not work for them. Dale Morrison, who farms in the New Dayton area, lost 240 hectares of winter wheat early in 1985. For the next two months he worked closely with Byers.

"We let the land lay bare for 16 days; there was nothing growing, no weeds, just black earth. After 16 days we dug up a patch and there were just as many cutworms as before. They were smaller, shrivelled, but when Byers took them to his lab and made food available to them they all started eating and were as big and healthy as ever in a few days. This was contrary to all past information which said that they couldn't survive that long without food."

Recent information now indicates that young larvae can survive for several weeks on the micro-organisms in the soil.

"By that time it was nip and tuck with the seeding dates, I just couldn't wait any longer."

Morrison sprayed and achieved a good degree of control on the land sprayed during a light rain. But it was not possible to spray such a large area all in one evening. (Late evening spraying is recommended as cutworms are night feeders). On the drier areas there was still substantial cutworm damage to the new crop after spraying and re-seeding.

"Next time I won't wait — I'll just spray right away."

Spraying does seem to be the only solution. Dale Morrison's views are typical of the Alberta farmer.

"No thinking farmer likes to put that stuff on his crops . . . this is the first time in 35

Larry Norris estimated that the insecticide cost approximately \$15 per hectare with another \$2.50 per hectare for application when he sprayed against cutworm damage at his farm south of Warner. In 1985 the government subsidized the spraying program which enabled more farmers in Marvin Prusky's area to spray.

"The trouble with grasshoppers is that



LARVAE EARLY SPRING THROUGH JUNE

there is very little you can do if your neighbor chooses not to spray. Before 1985 it was more economical for some farmers just to plow their land in."

Dale Morrison is comforted by the fact that "the Canadian government is one of the most vigilant about licensing chemicals." But they are still highly toxic materials, and despite elaborate safety precautions accidents can happen. Glen Roemmele was "good and sick for several days" after spilling a small amount of insecticide on his skin.

Many farmers, like Marvin Prusky, wonder about the long-term effects on the environment.

"After we sprayed the cutworms, the gulls moved in to clean up the dead ones . . . Most bee-keepers in this area have had to pull out their hives as the bees were destroyed by the spraying.

Johnson is investigating alternative methods of grasshopper control. In some cases insecticide is sprayed onto wheat bran and the bran is spread by the farmer on his land. This method, although slightly less effective than spraying and more difficult to apply, is more selective as it only kills grasshoppers.

This method is very promising, he says, as it allows the farmer to use much less of the

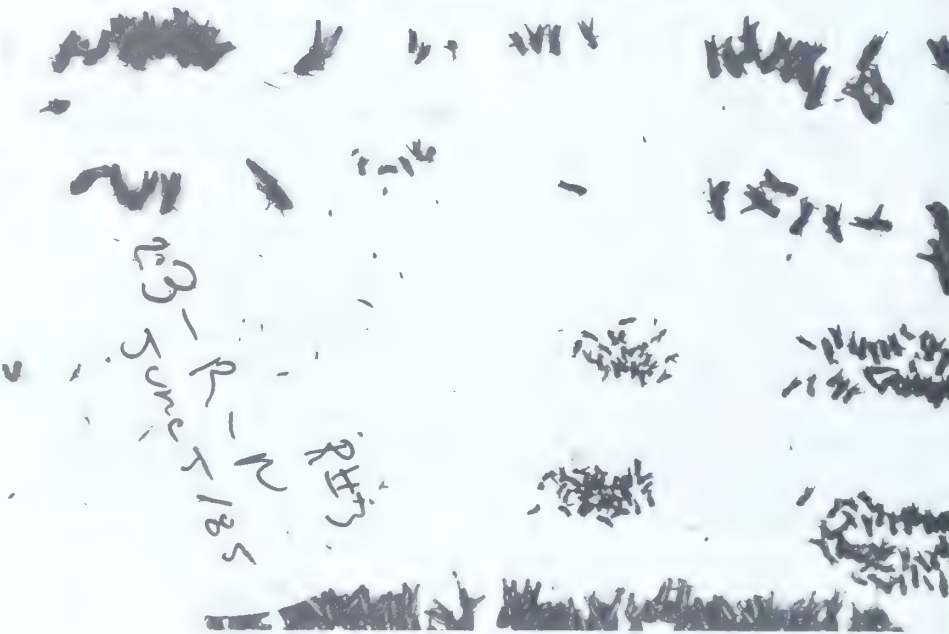
Using pesticides is a time- consuming, expensive and hazardous procedure.

years that I've used anything like it . . . But economically you don't have any alternative."

Alberta Agriculture distributes a series of crop protection guides to farmers, one specifically dealing with chemical protection, with comprehensive information regarding spraying instructions, grazing restrictions and safety precautions. In ideal conditions the spraying gives good results. But conditions are rarely ideal and it's also a time-consuming, expensive and hazardous procedure.



Bob Byers with pheromone traps used to attract cutworm moths for moth counts.



Two-striped grasshopper (above) and grasshopper sample taken from one survey site, in the Lethbridge Research Station.

insecticide (about one fifth) than if it were sprayed, reducing the toxicity and the cost.

Johnson and his staff are also investigating the introduction of natural diseases to control the grasshopper population. He has had some promising initial results testing *Nosema Locustae* (a microscopic parasite which lives only in grasshoppers) applied to bran baits. He is also experimenting with a group of insect-eating fungi, one of the major natural killers of grasshoppers. The grasshopper eats the spores which germinate and destroy the insect. The main difficulty here is that fungi only take hold under the right conditions.

"You need a large grasshopper population, the presence of the disease, and the right environmental conditions — moisture . . . Three or four years of dry weather can completely wipe out the spore base . . . The difficulty in using biological control is that you are working with two living organisms and they have to mesh . . . Eventually biological control will be part of grasshopper control, in conjunction with spraying."

The forecast for 1986 does look more hopeful for Alberta's farmers. According to Johnson, the actual area affected by grasshoppers will not decrease dramatically, but the level of infestation could be half or less of the 1985 level. In 1985 the area in southern Alberta severely infested during the grasshopper breeding season actually increased by 145 per cent over 1984. But unlike in 1983 and 1984, the area received a considerable amount of rainfall and cold weather in August followed by cold September weather. Grasshopper egg surveys show that the number of eggs laid per grasshopper in 1985 was only one quarter of the number laid per grasshopper in 1984. Be-

cause of the difference in the weather between the two years, the larger 1985 population left behind an average of only 40 eggs per square metre compared with well over 100 the previous year. Some areas, however, did not benefit from the timing of the rain as much as others and in those areas more eggs per breeding adult were laid. Unless spring weather is cool and wet these areas will experience severe infestations.

Byers and his staff have been measuring cutworm infestation since 1978 when pheromone traps were developed allowing cutworm moths to be counted effectively. These traps use a chemical which sexually attracts the male moths. The moth count in 1985 was 20 per cent higher than in 1984. But Byers feels that the moist conditions and the fact that many farmers were not on their fields during August and September will cut back on egg laying and the potential population.

Roemmele is optimistic about the grass-

hopper outlook for 1986 but wishes the problem could have been contained to a smaller area.

"The grasshopper problem starts small. It's like throwing a rock into a lake; the ripple gradually gets larger and larger. In '82 there was just the small circle, at the edge of my land; each year the area of infestation spreads two miles, and last year it spread four."

Both Roemmele and Marvin Prusky would like to see specific, subsidized government strategy in place to deal with the pest problem. They are both still very concerned about the 1986 potential cutworm problem and plan to be out inspecting their fields every day in early spring.

"I just hope that the cycle will have run its course by next year; people around here are in pretty bad shape. They've been hit and hit again; drought, grasshoppers and cutworms — they're a mean combination."

Hazel Sangster is an Edmonton freelance writer.

By Jim Wilson

Soil Conservation Strategies

The experts can't agree on the best management techniques



No-till seeding of winter wheat.

Fact: Almost half of our entire planet's land surface — 43 per cent — is inhospitable desert, its soil so lacking in organic matter that it cannot possibly retain any moisture or support any significant plant life.

Fact: While most of that desert was climate-created, fully seven per cent of it has been created by man, and that figure is increasing.

Fact: Much of that man-made desert was rich, productive farmland only a century ago. Just like Alberta.

The word "drought" has been absent from our common Alberta vocabulary for a half a century. But with the very dry summers of the past few years and the current extremely dry winter and spring, it is returning.

Drought can be the forerunner of desert. The onslaught of desert can be caused by many things — frequently, for instance, massive deforestation which permits equally massive erosion of rich topsoil, which results in lifeless soil that cannot support crops or hold moisture

— which leads to desert landscapes.

But the basic definition of "desert" involves an area's aridity and lack of precipitation. Whether it's polar desert or hot desert, it is a land that receives less than 250 milli-

In dry years, all that's really standing between Alberta and a sort of sub-desert land is good soil management.

metres of moisture per year.

If we look at the amount of moisture Alberta receives during the growing season, we find it is far less than that 250 millimetres. We do not live in desert conditions because of two factors: winter moisture that our watersheds store for spring and summer river flow, and the moisture our rich topsoil absorbs from melting snow in the spring, and from summer rainfall.

We are already seeing the result of low rivers due to dry winters and summers. If that persists, all that's really standing between Alberta and a sort of sub-desert land is good soil management.

Much of the man-made desert mentioned earlier can be blamed almost entirely on bad soil management. As it continues, the countries involved lose hundreds of square kilometres of farmland every year.

The economic cost of that loss is staggering, but the cost of repair is impossible to calculate.

But there are more factors to consider:

How do we conserve our soil resources so they can feed future generations, while still making effective use of them today? How can our farmers practice sensible but frequently expensive soil conservation techniques, and still stay in business? And, how much are we willing to pay as a society to help those farmers practice soil conservation, when what that really accomplishes is to provide arable soil not for us, but for generations living in the 21st century?

On the social side of the problem, as a society how much degradation of the soil resource that provides our "bread basket" are we willing to allow by farmers, in their attempts to keep their costs down and their farms viable?

Modern agricultural technology provides many effective means of keeping our soil resources able to grow rich, healthy crops. And when coupled with the traditional methods and knowledge of our farmers, this technology can help to control erosion, drought and soil degradation almost entirely.

"That's not something to be ignored," says John Kolkman, research and policy co-ordinator for the Christian Farmers Federation. "Many of our farmers believe that agricultural land is not owned by farmers in the absolute sense. We are really the stewards of that land — it has been entrusted to our care, for the benefit of today's and future generations."



Stunted plant growth in a southern Alberta field during the thirties.

Just as chemicals used in soil conservation cost the farmer (and indirectly the consumer of the crops he grows) significant amounts of money, so does the alternative of doing little or nothing. When poor soil management results in soil that grows very poor crops, the result is also high food prices.

"The value of soil degradation, from erosion and poor soil management practices, has been estimated by the PFRA as hundreds of millions of dollars a year in Alberta," Kolkman says.

Crop loss payments due to drought in Alberta were \$500 million in 1984 — and a similar amount has been estimated for 1985. This year, 1986, could be even worse.

Alberta Agriculture's John Hermans, in fact, has predicted wind erosion this winter and spring will be three to five times that of 1985 — which he says was the worst since the cataclysmic 1930s dust bowl years.

Still, it's extremely difficult to know what to do in Alberta, because the range of moisture, soil types and general climatic conditions is so broad, and the cost to the farmer of using the wrong technique can be as bad as doing nothing at all.

There are several soil management practices available to control erosion and weeds, retain moisture and generally enrich the farmer's soil resource. These include summerfallow, zero tillage, reduced tillage, chemical fallow and continuous cropping.

Summerfallow, one of the most traditional, involves leaving up to half of the land uncropped for a year, in order to control weeds and let the soil rest. The summerfallow land is

normally tilled — dug thoroughly with a cultivator — at first to bury the stubble for organic enrichment, and subsequently to cut down weeds in order to inhibit their growth.

"Generally," says Tom Jensen, an Alberta Agriculture soil conservation specialist, "when you get into the drier zones of the province summerfallow has its place for moisture conservation — particularly when there are



Tom Jensen

as many dry years as we've had recently. (With no crops, the soil's natural moisture content is not as heavily consumed.)

"In the wetter areas, summerfallow can be used for weed control, but it's not necessary for moisture retention."

Stubble is also plowed into the land that is cropped, of course. In both cases the cultivation process leaves a loose soil surface that can easily be the victim of wind erosion.

And when you can see dust in the air, Jensen says, you are losing 10 to 12 tonnes per hectare from drifting during the average storm. In bad storms that can increase to 250 tonnes per hectare — and it doesn't return.

But Sheldon King, president of the Alberta Farmers Conservation in Crop Production Association and a farmer working his own 1,400 hectares, says that in dry years traditional summerfallow can be extremely hazardous.

"Each cultivation of the summerfallow land costs about half an inch of soil moisture (since a new layer of moist soil is exposed to the air)," he says. "On average a summerfallow field is cultivated for weed control four times — that's two full inches (five centimetres) of moisture lost for the next year — and that amount is sufficiently critical that it can make or break a crop." Leaving stubble on the field, he says, could avoid this problem.

Still, summerfallow costs the farmer little in terms of direct investment, which makes it an attractive alternative.

To combat the erosion hazard, many farmers leave the stubble completely or partially on the fields. New crops are planted right into the stubble of the previous year's plants.

There are many variations of this approach.

In "zero tillage", Jensen says, "the crop residue is left from the previous crop, and the only soil disturbance is during seeding. Weed control is accomplished with herbicides — there is no summerfallow." The stubble is simply sprayed with herbicides to control weeds, and then seeded.

In "reduced tillage", which Jensen says is "the most practical in the end", the stubble is tilled very lightly, leaving a substantial amount of crop residue on the surface. The result is then sprayed with herbicides and seeded.

When a farmer still wants to leave a portion of his land in summerfallow, this method can be adopted in what is known as "chemical fallowing". The land is left to rest for a year, but it is not cultivated. Weeds are controlled instead by several applications of herbicides. But the soil surface is kept stable, reducing wind erosion hazards. The stubble surface also significantly reduces costly moisture loss — and indeed, can even help to collect and save some rain and snow moisture for the following year, retaining up to 1.5 centimetres

GLEN BROW ARCHIVES

FRED KATZ

of plant-available water.

"The problem here," says Sheldon King, "is that costs are up to 10 per cent higher for these methods than for the more traditional ones. Chemical fallow, for instance, costs \$2 to \$3 an acre more (\$5 to \$7 per hectare) — and that's a lot of money on a large farm.

"But how," he asks, "do you measure the value of the moisture you save in utilizing chemical fallow? I think it comes out even."

As a first step to zero tillage King and his association strongly advocate another conservation approach continuous cropping, in which there is never a fallow field situation. Instead, crops are frequently rotated for weed control, moisture retention and mineral replacement.

"From there you can develop your cropping plans to accommodate your area of the province, soil types, moisture availability — a whole group of factors," he says.

This approach requires more sophistication in soil management, King says, but it



Sloughs dried up all across the prairies during 1984 and 1985.

In a bad storm 250 tonnes per hectare of topsoil can be blown away.

makes economic sense nevertheless, because it will save money — and soil quality — in the long run.

And he adds that use of the approach is increasing by two to three per cent a year.

Kolkman is less ecstatic about chemical methods, but says he agrees that "we've overdone it in summerfallow. Its negative effects on soil quality and productivity over the

long term have been substantial. The economic costs of that degradation are incalculable. Our organization supports the reduction of summerfallow, and better conservation of our soil resource."

And to the extent that summerfallow must be used, "prudent use of herbicides is certainly an acceptable alternative." Nevertheless, he says, "herbicides can be extremely expensive — so the jury is still out on their cost-effectiveness."

But regardless of all considerations of the direct costs of good soil management, as Kolkman says, no matter what soil conservation methods anyone might prefer for whatever reason, "if we don't manage our soil well and we let it degrade over time, we're going to have to spend ever-increasing amounts of money to make up for what's not there — more fertilizers, more money to move water, the costs of erosion both in soil loss and in cleaning out culverts and silty rivers."

"It will be far cheaper in the long run to prevent the problem from taking place."

Tom Jensen advocates what he terms "flexible cropping," which takes into account all contributing factors of available moisture and annual moisture patterns, types of farming and so forth. And he says many older farmers know what's best for their land. "You can't knock that," he says, "but if they just blindly follow tradition when the situation changes, it can be disastrous."

He believes in using reduced tillage wherever possible, particularly as a hedge against wind erosion. "However," he admits, "it's hard to show that value in economic terms



Alberta Agriculture predicts wind erosion this spring three to five times worse than 1985.



Lethbridge area farmer Doug Murfin with his "dried-up dream".

because soil loss from wind erosion takes place over a number of years. In the short term it's really hard to see any benefit.

"There's also a significant emotional problem here. If you do a good job of soil conservation today, spending whatever is necessary, you may not be the one who benefits — the future users of the land will benefit.

"And the basic consideration is that you can't go broke. If you do a wonderful job of soil conservation and you go broke, you've lost everything — it certainly hasn't helped you."

There is one more problem, however, and it's a fundamental one: no one really knows what form or forms of soil management will work best.

Rod Raines, research director for the Alberta Hail & Crop Insurance Corporation, has a troublesome observation: "Our premiums are based on risk, just like any insurance program. And we look at where we pay claims and where we don't.

"Statistically, as a result, we see all sorts of things that we wonder about. For instance, in the last two years we've paid more claims to farmers using continuous cropping than we have to others using part cropping and part fallow — and those farmers are frequently right next door to each other."

Both techniques are among the accepted forms of good soil management.

"What I really wish," says Raines, "is that the agrologists and economists would get together and decide what is best — and then tell the farmers and us, so we'd all know."

Raines touches on a critical point: there is insufficient information available describing Alberta's diverse soil and moisture situations to enable a farmer to make definitive decisions on "the right" soil conservation techniques.

Kolkman agrees. "We just don't know what's best. Some people do well, some don't — and it changes from year to year. It's a confused and mixed bag."

Kolkman and King and many others are particularly concerned about that problem, because they strongly view themselves as stewards, not owners, of their land, responsible for keeping the soil alive and well and thriving for future generations.

"We really can't afford not to spend what it costs for good soil management," Kings says. "We can't let our farmers go broke of course, but we all — not just the farmers — benefit from our soil resource, and as good stewards of that land, we have to make sure it is all still there for future generations."

"Soil conservation does cost money. But what will the costs be if we don't stop the soil degradation that's occurring throughout Alberta? If it continues long enough we really could become another Ethiopia, with no organic matter left in our soil, so that it has no moisture-retaining ability and simply can't grow anything.

"That," he says, "is drought."

And unless we spend the money to find the *right* methods of soil management for Alberta, there's always the chance that Kolkman could be right, and Canada's prairie bread basket could become a 21st-century desert.

Jim Wilson, a former journalist, is a Calgary freelance writer. He is currently publishing a book on Kananaskis Country with his wife, Norma Ramage.

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Eric A. Bailey

Shrinking Wildlife Habitat

Drought conditions take their toll of waterfowl and other creatures



DUCKS UNLIMITED

Come for a trip across the largest natural lake in southern Alberta. Forget the boat — we'll walk. Bring your rubber boots, though, we may dabble in the mud puddles and marsh grass. But leave your fishing gear at home. The cattle and the antelope that now live in Pakowki Lake, southwest of Manyberries, aren't biting.

The lake succumbed to the drought. Low precipitation, low runoff, dry winter winds, hot summers, plant growth and cattle have used up the water. Small-scale irrigation projects snare most of the meager runoff before it can reach the lake.

"When something as severe and demonstrable as this happens, you know there's a big problem out there. Sometimes it terrifies you to think of the future," says Lorne Fitch, regional habitat biologist for Alberta Fish and Wildlife in Lethbridge.

"In 1985, the Oldman River was down significantly, Willow Creek and other streams on the east side of the Porcupine Hills were severely affected — many dried up completely.

In southern Alberta in 1974 there were 1.5 million ponds. By 1984 there were fewer than 600,000.

"Stream and river valleys are really oases in this part of the country. When stream flows go down, the water table goes down and we lose river valley vegetation."

You may have gone perch fishing on Clear Lake west of Nanton 15 years ago. Now, there's barely enough water to float a boat.

Although an inviting blue on Travel Alberta's 1985 road map, Frank Lake, just east of High River, is frankly an ex-lake. The Ducks Unlimited dam at the outlet lends irony to a flat, dry landscape no duck would look at twice.

The Canadian Wildlife Service counted 1.5 million ponds in southern Alberta in May, 1974. In May, 1984, they found fewer than 600,000. It was observed that ponds were almost non-existent southwest of a line between Calgary and Medicine Hat.

"In '83 and '84 we had fairly dry summers and one of the biggest results was severely reduced stream flows," said Dave Christiansen, regional head of habitat for Alberta Fish and Wildlife in Rocky Mountain House.

"In fact, the north fork of Prairie Creek just about dried up. In places the flow just disappeared into the gravel. I'd turn over a big rock and see hundreds of dead sculpins. I suspect we've lost a good portion of our brown trout fishery for a number of years."

Christiansen said that when a stream goes into the fall with very low water there may easily be a loss of muskrat and beaver colonies.

Pheasant eggs literally dry out in low humidity. Alberta Fish and Wildlife's 1985 surveys for southern Alberta show numbers of pheasants down 75 per cent in one year. They suspect sage grouse are also in trouble as the chicks feed on tender wetland vegetation.

Surveys of prairie mule deer show an average of 74 fawns per 100 does in 1980 but only 55 per 100 in 1985.

Canada geese haven't been able to nest in the grasslands during the drought and have moved to the parkland in search of more permanent water.

Other species resist the drought. But that resistance can bring them to grief. Antelope are a case in point.

"We started into the drought with very high antelope and deer populations, and at first farmers were very tolerant," said Lorne Russell, head of wildlife management, southern region, Alberta Fish and Wildlife.

"But, by 1984, farmers were fed up with sharing the land and their crops and we had to try to increase the antelope harvest."

In fact, the antelope population prior to 1984 had reached 29,000 in southern Alberta,



the highest ever recorded. By the summer of 1985, that figure dropped to about 24,000, partly due to reduction in kid production. These numbers still exceed department's targets.

Interloping antelope aren't the only animals to run afoul of drought-plagued ranchers and farmers. Russell said they now get complaints about wild animals using grass on grazing reserves and leases. While demand for public grazing land continues, stocking rates (the numbers of cattle permitted) are reduced to prevent grass damage and to protect Fish and Wildlife reserves vital wildlife habitat from grazing.

One public lands officer observing some muskeg once cursed with clouds of mosquitoes said it's so dry you now have to peer through a cloud of grasshoppers to see it.

The grasshopper thrives in dry times but our efforts to control it have affected other species such as ground-nesting birds. In 1985, Alberta Agriculture studied nests hit with insecticides aimed at hoppers in the Nanton area.

"We found a slight reduction in egg viability, a slight reduction in hatch success and a slight increase in mortality (of nestlings)," said Dr. Michael Dorrance, head of the problem wildlife section, adding that reduced survival rates were "substantial enough to cause us some concern."

Agriculture removes wetland habitat crucial to waterfowl production on the prairies. During dry times, cattle concentrate around the few available wetlands, trampling vegetation and nesting cover at the margins.

Drought shrinks or dries up wetlands, allowing cultivation. Once cultivated, the land is rarely returned to its natural state.

CWS surveys show that nearly half of all basins and over 90 per cent of margins have felt the impact of agriculture in southern Alberta.

"Pond numbers in prairie parkland and grassland regions regulate the abundance of duck populations in North America," says Bruce Turner, wildlife biologist with the CWS. Mallard and pintail, the number one



Gary Stewart

*Insecticides used
to fight
grasshoppers
affect the breeding
of ground-nesting
birds.*

and two game species on the continent, nest in this region. CWS reports breeding populations of both species are about 25 per cent from the long-term average.



Reduction in sport species produces a quick and aggressive response from sportsmen. Ducks Unlimited (DU), incorporated in 1937, funds wetland conservation projects across Canada using private donations, primarily from American duck hunters. They have built about 400,000 hectares of managed wetland in Alberta, last year spending \$8.5 million here of its \$40 million national budget.

"Integrating wildlife habitat with agriculture is our bread and butter," says Gary Stewart, Alberta provincial biologist, Ducks Unlimited Canada, "if we couldn't provide tangible benefits to agriculture we couldn't get co-operation."

"We have to rely on spring runoff for our water supply," says Jerry Brunen, DU's Hanna Area Manager, about the 230 small projects he manages. "We build dams along coulees, creeks and wetlands in an attempt to drought-proof the prairies by creating permanent wetlands."

The Dan project, northeast of Hanna is more ambitious. A large reservoir (3.7 million cubic metres) fills with spring runoff and maintains a 35 kilometre long creek and four smaller reservoirs downstream all summer.

"The value to agriculture in watering cattle, growing forage and spreading the cattle throughout the range is as great if not greater than the value to waterfowl," said Brunen.

"These projects turn dry land into green oceans of lush wetland vegetation. And we've noticed a big influx of birds — especially blue-winged teal and shoveller and we now see pintails and mallards as well."

DU's new Kitsim project is in the middle of an Eastern Irrigation District grazing field south of Brooks.

"We have an irrigation reservoir nearby and we let Ducks Unlimited use off-peak water when the demand is slow," says Jim Webber, the EID's Assistant General Manager and District Engineer.

DU pumps water up to a smaller, higher reservoir from which they feed water to about 450 hectares of wetland consisting of 69 ponds within a 50-square-kilometre range.

"The ponds were really dried-out salt pans



The Oldman River near Monarch. Rainfall hit record lows in June, 1985.

Waterfowl Plan



Small success stories can be found in managed wetlands throughout the prairies but the larger picture is still disheartening. The biologists agree it's impossible to restore all the habitat lost to drought and agriculture over time. They hope, though, to bring waterfowl populations back to the levels they were in 1974 before the present drought began.

To that end, Canada and the United States drafted the *North American Waterfowl Plan* which proposes objectives and strategies for protection and maintenance of waterfowl populations and habitat, joint Canada-US research and management projects, and the regulation of hunting.

Ducks Unlimited's Gary Stewart thinks it will work. "This is the first time in history that the US, Canada, federal, provincial and state governments have agreed on a course

of action and we're going to see this thing go ahead."

But then Stewart waxes optimistic about ducks even at the worst of times.

"We've come a long way from the horses and plows of the '30s and '40s in terms of the impact we have on the land and we'll never see the numbers of birds we once saw. But ducks can bounce back and they will. We're confident that through soil and water conservation practices in co-operation with agriculture we can bring the numbers back to a decent level," he said.

Other species are waiting to bounce back too. The prairies naturally go through drought cycles and wildlife has been through dry times before. If we don't destroy habitat while it lies dry, it will surely return with the rain.

— Eric A. Bailey

with little grass worth," Webber said. "But the first year the project went into operation, the grass was quite fantastic, I was really impressed.

"We were a little skeptical to start with because shallow pond technology was new to Ducks Unlimited. But grass produced in the first year turned the ranchers around 180 degrees because cattle came off fat and glossy."

And the ducks? DU reports that Kitsim, which produced no consistent broods prior to development in 1982, produced more than 400 broods in 1985 — about 2,000 ducks which survived to migrate south last fall.

Many private farms incorporate managed wetlands to increase productivity and provide waterfowl habitat.

"There's not much difference between good agricultural management and good wildlife habitat management."

"There's not much difference between what we think is good agricultural management and good wildlife habitat management," says Lawrence Kallal who ranches and farms 1,000 hectares southeast of Tofield.

Kallal traps spring runoff and backs it up or diverts it onto over 80 hectares of wild hay fields.

"We leave the water on the land long enough for waterfowl to breed and to start a good hay crop. If it hasn't dried out by June 1, we start draining it.

"Last year the weather was dry until August. The tame hay was really short but the wild hay was good. Without that wetland we would have been in real serious trouble."

The ducks and geese Kallal enjoys seeing on his wetlands and his registered red poll Herefords thrive on the production of exactly the same land.

Eric A. Bailey is a freelance writer specializing in outdoor and interpretive writing, working from Alder Flats, Alberta

Norma Ramage

Droughtproofing: Large-Scale Solutions

Irrigation, cloud seeding and other costly approaches



A farmer stands and watches valuable topsoil blowing away in the wind.

A young couple is forced to abandon their house because the lawn, the trees, even the paint on the walls has been devoured by voracious hordes of grasshoppers.

A man is injured in a multi-car pileup because visibility is obscured by clouds of blowing dust.

These scenes all took place in Alberta. But not in the Alberta of the Dirty Thirties. Instead, these events occurred in southern

Alberta in the last two years, during the droughts of 1984 and 1985.

They bring home the message that drought is not something that happened only to our parents and grandparents, but is something that's happening today and will keep on happening in the future.

But although drought is a problem today's farmers share with their predecessors of the Dirty Thirties, they have something the previous generation didn't have — a vast array of technological weapons to mitigate the ef-

fects of drought, from irrigation to cloud seeding. But using these weapons is not as simple as it seems because there are important economic, environmental and social implications that must be weighed.

Even irrigation, in use in Alberta since the turn of the century, has its pros and cons.

The positive effects of irrigation are straightforward. "The most important aspect of irrigation is the stabilization of the regional economy," explains Alberta Agriculture's provincial irrigation economist Tony Van Deurzen.

Farmers with irrigation can count on harvesting a crop year after year and on having a steady cash flow to enable them to continue to operate.

Jim Barlিশen, an economist with Alberta Environment, gives one example of the benefits: "If you irrigate 170,000 acres of land, you can triple production, producing the equivalent of more than 500,000 acres of dryland."

But for some experts, the benefits are outweighed by the costs and by the fact that a large number of people pay to benefit a few.

Terry Veeman, an associate professor of agricultural economics at the University of Alberta, notes that only 10 to 12 per cent of provincial farming is carried out on irrigated land yet the high costs are footed by taxpayers as a whole. "I am both pro-irrigation and pro-agriculture, but I think the whole matter is more complex than what is good for individual farmers. It's a question of where to put our money for the best use."

Veeman argues that from an economist's viewpoint, irrigated agriculture on the prairies provides only limited returns for large expenditures (more than \$600 million since 1980). Although irrigation allows crop diversity, says Veeman, most crops grown on irrigated land tend to be the relatively low-value tried and true crops such as small grains, hay and pasture.

The number of frost-free days, farmer expertise and market demands all play a part in what crops are grown, no matter how efficient the irrigation.

But Barlিশen believes economists may fail to take into account the less visible, secondary benefits of irrigation. "Irrigated land farming is more intensive," argues Barlিশen, "and requires a greater population. When a population base grows, the community grows and all the amenities like education and health grow along with it. Without irrigation, Leth-

LESTER K. HEROLD

bridge and Taber would likely be more like the smaller dryland communities to the east."

And there are spinoffs from a healthy farm economy, says Barlshen. Businesses in the community prosper because they know they will have assured clients from year to year because farmers on irrigated land will always harvest a crop. And these benefits can spread beyond Alberta. Higher grain production or greater conversion of grain to cattle means increased business for the railroads as prosperous farmers buy machinery from Ontario plants.

But Veeman still questions whether the benefits are always worth the cost. "All developments have some impact on the economy. The question is whether the money is best spent on education, oil sands or a variety of other developments. "He also believes the cost can only escalate because much of the land best-suited to irrigation has already been developed.

Alberta Agriculture's Van Deurzen cautions both critics and supporters of irrigation not to consider it an instant panacea for drought. "Some people say that irrigated farming provides five to six times the value



Terry Veeman

to the economy as dryland farming but that's erroneous. Five to six times the amount of money may change hands but that's not necessarily the economic benefit," he argues. Any realistic figure must take into account the costs of irrigated farming. "Capital costs may be three times that on dryland and cash costs are double those on dryland, maybe 10 times as much when you talk about specialty crops like potatoes."

Irrigation has its pros and cons

Van Deurzen proposes what he considers a more realistic cost-benefit ratio: "If dryland farming is a 1 to 1.25 cost-benefit ratio, then irrigated farming is 1 to 1.5."

Says Veeman, "Irrigation is politically popular. It's also a natural reaction when there is a drought, such as now, to consider that the answer is to provide irrigation. That's a shade too simplistic. We can never really solve the problem of drought."

John Eisenhauer, executive director of Trout Unlimited, thinks farmers and government don't look at enough alternatives to irrigation. "It's expensive. We, as taxpayers, should look at the long-term returns, not just benefits in occasional drought years.

"Promoters who think irrigation means we can grow oranges in Hanna just aren't looking at the realities."

Van Deurzen says simply, "Putting everything under irrigation in southern Alberta is not the solution. In 1985, many people farming on irrigated land lost money, too, because of the inability of the (irrigation) system to provide enough water. The system is designed for average-year rainfall, not for extreme drought situations."

The advisability of using irrigation in an area depends, too, on availability of water, whether there are markets available for crops that might be grown and on whether the soil type is suitable for irrigation.

This last question and the related question of soil salinity are becoming increasingly important in any discussion of the pros and cons of irrigation.

Brook Harker, head of the drainage reclamation section of Alberta Agriculture's drainage branch, says salt content of soil is a matter of major concern on all prairie land, irrigated or not. "The rate at which dryland is salinating is considered to be one of the most serious problems in Western Canada," says Harker and a committee has been set up to assess the degree of salinization. He estimates about 15 to 20 per cent of Alberta land is saline.

Although salinity can occur on non-irrigated lands because of such things as farming practices and vegetation changes, irrigation aggravates and accelerates the process.

On irrigated land, crops may not absorb all the water, so that it accumulates and raises the natural water table. As the water rises, it accumulates salts, raising the salt concentration of the soil. Seepage from irrigation canals is also a major cause of salt increase in soil.

If the process goes too far the result is a thick white crust of salt that can be seen on fields and sloughs. At this stage, the land is sterile. But land can be reclaimed by sealing canals and by draining the land by a system called tile drainage, explains Harker.

Unfortunately, tile drainage leads to another problem — an increase in salt in rivers themselves. The water being drained is high in salts, up to 20 times the salt content of the river it is draining into, says Harker.

"While the water produced by tile drainage is very saline, there is very little volume," he explains. "In Alberta, we only drain the land for two or three months. It's not like California where they're pumping high volumes of saline water into their river systems year round."

Harker points out that the salt content of the Oldman River is approximately 300 parts per million. Without irrigation drainage, he estimates it would be 250 parts per million. "Compare this to the Colorado with up to 1,100 parts per million and you see that Alberta's rivers are very pure. And recent studies show that maintaining the current rate of tile drainage would only have a three per cent effect on water quality in the South



Arleigh Laycock

Saskatchewan river system by 2005," Harker says.

Other problems with irrigation arise when dams and off-stream reservoirs are considered. Spring runoff comes in May and June but water is needed by farmers in July and August. On the one hand, dams regulate that flow and provide water when it is needed. On the other hand, both dams and off-stream reservoirs can flood areas of productive farmland



Open irrigation canals carry water from the Oldman River.

or recreation and wilderness land.

Says Barlishen, "It's all about making the best use of land, a trading off. It's important for people to have fun on their leisure time, to go fishing, there's no doubt about that," says Barlishen, but he adds it's important to provide water for agriculture and municipal use.

Trout Unlimited's John Eisenhauer agrees, but he feels the quality of those trade-offs could be improved. "Alberta Environment operates on a system of crisis management," he says pointing to fish kills on the Highwood River in 1984 and 1985 due to large withdrawals from the river to supply the Little Bow River irrigation and the needs of a \$20 million fisheries industry. It's an absolutely idiotic philosophy to say have one at the expense of the other."

Dick Hart, Alberta Environment's senior river basin planner for the southern region, says all water uses are carefully assessed. "In the case of the Highwood, there were extreme drought conditions and a decision had to be made to allocate scarce water supplies to users. A three-man committee of directors of Alberta Environment looked at each critical use situation individually and then decided on the best allocation."

But the controversy over droughtproofing methods doesn't end with irrigation. Even more controversial is the concept of inter-basin water transfer. This is the transfer of water from a resource-rich area to a dryland area. At its extreme, this could mean taking water from the Peace River and channelling it to the water-starved areas south of Calgary.

Dr. Arleigh Laycock, a professor of geography at the University of Alberta, points out that water transfer is not a futuristic dream but already a fact of life. For example, water is transferred from the Bow to the Oldman and from the Bow into the Red Deer River, and all rivers within the larger South Saskatchewan Basin system.

And approval was recently given to ship water through a pipeline from the North Saskatchewan River to oil sands developments 90 kilometres away in Cold Lake.

"Irrigation is politically popular."

But it's the concept of major inter-basin transfer across water basin divides — such as from the North Saskatchewan to South Saskatchewan — that creates controversy, says Laycock. "It's touchy because the early studies were grandiose and expensive. These studies were done by engineers and they were great for engineers but not for anybody else because of the horrendous costs involved."

A provincial-government-sponsored study started in 1981 came up with a "ludicrous" proposal of open canal transfer, says Laycock. The study, he says, suggested an open canal "two and one half times the size of the North Saskatchewan River" that would take water from the Peace River to southern Alberta. "They estimated a cost of \$10 billion and that was likely only half the cost." Laycock also says the environmental damage would have been "substantial" to fish, wildlife and the ecosystems of both the donor and recipient.

The study was done on too large a scale, says Laycock, and made the government "gun shy" about the whole concept of water transfer.

Today, according to Peter Melnychuk, assistant deputy minister for Water Resources Management Services, Alberta Environment, says, "The water management policy is that the water in each major river basin must be fully and efficiently utilized before inter-basin augmentation could be considered."

But Trout Unlimited's Eisenhauer believes the government is planning inter-basin water transfer in the future. "Everything the government is doing is moving them towards it. To irrigate the amount of land they talk about irri-

gating, to meet irrigation expectations and inter-provincial agreements in the future, they need water transfer."

Laycock doesn't think water transfer is needed yet. But he's not ruling out the possibility that it may become necessary in the future. He believes it isn't too early to investigate smaller, sequential water transfer plans that could be done more cheaply and with less environmental impact.

In the meantime, some futuristic scientific advances offer hope for another kind of drought mitigation. The Alberta Research Council is in the forefront of world research into seeding clouds to produce rain and snow. Dr. Bob Humphries, head of the Centre's Atmospheric Sciences Department, says experiments conducted in conjunction with its hail program have provided "very, very strong evidence we can manufacture rain" by seeding clouds with silver iodide.

However, continues Humphries, the clouds must be the right kind of cumulus, "the tall, puffy summer clouds that look like they're going to rain but then dissipate and don't."

Out of 70 or 80 experiments the centre analyzed, said Humphries, "Every cloud we seeded and that didn't dissipate within 20 minutes, has rained."

Humphries is similarly hopeful about experiments to seed winter clouds to produce snow and increase spring runoff. He says ARC experiments in 1983 and 1984 showed clouds are not very efficient snow makers and that a lot of super-cooled liquid within them was not being converted to snow. Seeding with silver iodide could freeze this liquid and turn it into snow. Similar experiments in the United States have increased snowfall by 10 per cent, says Humphries.

However, experiments in snow seeding have been limited and he feels a \$6-million, three-year study program is needed before full-scale cloud seeding gets underway. The cost of such a program would be more than offset by its "considerable benefits", says Humphries.

Dr. John Maybank, director of the environment council of the Saskatchewan Research Council, is also hopeful about snow seeding although he is more skeptical about the benefits of seeding clouds for rain during drought times.

During drought, he explains, skies are typically blue and cloudless and there are "simply no clouds to seed".

But whatever "droughtproofing" methods are found to be best, there is little doubt that after the drought of 1984 and '85 and with the possibility of another dry summer this year, that there will be demands to accelerate and improve the process.

Linda Goyette

Droughtproofing: Small-Scale Solutions

Small projects can make a big difference



It is Nov. 19, 1979, a night to be remembered in New Dayton, Alberta. Here, in the parched country southeast of Lethbridge, water is measured by the cool, clear drop. At 5:30 p.m., a lonely pump begins to chug at the Ridge Reservoir. At 7:30, a farmer stoops to adjust a troublesome valve in a 13-kilometre stretch of new pipeline. At 9:55, with worried men checking their watches, the first trickle arrives at the storage tank in the tiny hamlet. Jubilant farmers head to the telephone at midnight to wake up their MLA with the good news: "The water is on at New Dayton!"

The 45 families in the district paid a high price in sweat and sore muscles for the 300 litres that now arrive at the storage tank every minute. In a 44-day marathon work bee, 28 local men donated 2,112 hours of volunteer labor to build the pipeline. "Some of us worked 16 or 17 hours a day," recalls Roy Schoen, a farmer who helped organize the project. For years, residents had hauled water from other towns. They had carefully rationed dishwater and showers and had surrendered all hope for abundant vegetable gardens or green lawns. Some people had even taken

drinking water from irrigation ditches. They were fed up.

"We just felt that in the 1980s, everybody should be able to have a drink of water when they wanted one," says Schoen. "It was our goal and we worked toward it until we got it."

Battle in the trenches is worth it.

The pipeline project, supported by Alberta Environment, cost \$152,000. It did not work miracles. During the drought last summer, farmers began lining up at the storage tower at 5:00 a.m. and the 32,000-litre tank was often empty by noon. "But without it, we would have had a terrible year," says Schoen, adding that the system has since been expanded to bring more water to homes, sprayers and livestock.

Schoen realizes farmers and ranchers in southern Alberta can't win the war against drought with 13-kilometre pipelines. But the fight has to start somewhere. He thinks every trench battle is worth the effort.

Expensive irrigation projects and giant reservoirs are crucial to agriculture on the dry prairie. Still, small-scale solutions to the drought menace can often be implemented with less cost and disruption. Alberta farmers rely on five modest approaches to drought prevention: small water delivery projects, such as the New Dayton pipeline; repairs to the existing irrigation system; sensible soil conservation; snow capture to maintain moisture in dry fields and, finally, the development and use of drought-tolerant crops.

In good years, farm households draw adequate drinking, washing and gardening water from nearby wells. Their thirsty livestock lap up water from dugouts and stock-watering dams, small streams and irrigation canals. The catastrophic droughts of 1984 and 1985 put an unbearable strain on existing water delivery systems in southern Alberta. Walter Nemanishen, a planning engineer with federal

Prairie Farm Rehabilitation Administration (PFRA), led a seven-man team to investigate the emergency. By September 1985, he had talked to every municipal council in the drought area. Although deeply frustrated, local officials impressed Nemanishen with their innovative proposals for water projects.

"The farmers and ranchers are strapped to the limit," he said. "They're going under. We need those small-scale methods of drought prevention and we need them fast."

The PFRA team recently completed a brief on its investigation: the Alberta Water Sourcing Study. The report lists 57 potential water projects, all ideas from the municipal councillors. "It was a massive effort from all the farmers and ranchers in the drought area," said Nemanishen. "I hope they will now begin to lobby for their proposals."

The list is dominated by a request for 33 new stock-watering reservoirs to be built at the headwaters of streams where most snow accumulates. Water could flow through natural channels or pipelines to downstream pumping sites. The rural officials said existing dams need to be repaired and maintained. New water diversion canals must be built from

sistence and new funding for long-term projects. Thousands of tax dollars are earmarked for new small-scale water collection schemes, including 12 group pipeline projects to begin south of Calgary this spring. Alberta Utilities and Telephones has introduced its own pipeline assistance program.

Nemanishen says these efforts are commendable but he points to growing confusion among farmers. How can they tackle a small, local project when so many government agencies are involved? Who

should they approach for financial help? "We need a co-ordinating agency that could drive the project through from beginning to end," says the Calgary planning engineer. "There is too much fragmentation right now."

In Red Deer, another engineer is studying innovative water pumping techniques already in use in southern Manitoba. "It's no big scientific breakthrough but it is something that could be adapted in Alberta," says Mel Crompton of Alberta Environment. Dryland farmers in drought areas now rely on long alu-

Drought Country Heroes

Quiet agriculturalists rarely appear in the rough-and-tumble tales of the Canadian West.

They can't compete in the public imagination with cowboys, Indian buffalo hunters, Mounties, saloon madams or Metis rebels. Still, they're heroes in drought country and for good reason.

Consider the contributions of Charles Noble and Dr. Asael Palmer, two Albertans who made a lasting imprint on the rural landscape far beyond the borders of their own province — in fact, as far as the arid plains of Siberia.

The Noble story is a rags-to-riches saga. In 1902, the ambitious 29-year-old left his North Dakota farm for a new homestead at Claresholm, Alberta. He broke his first section with a walking plow and two oxen. Noble worked part-time as a land agent for the Canadian Pacific Railway and, within six years, was selling 400 hectares a day to American farmers. He expanded his own land holdings so that by the end of World War I he was a millionaire with 13,000 hectares, owner of the largest grain empire in the British Commonwealth.

Drought, cutworms, grasshoppers, hail and falling grain prices brought disaster in the early 1920s. Although Noble's farm inventory exceeded \$2.5 million, his creditors became impatient. In 1922, they foreclosed and Noble lost everything, even his original homestead. "I am determined to be a good loser," he wrote to a local MP. But he was not defeated for long.

Noble leased his old, four-section farm for two years, then bought it back. He quickly reassembled his grain operation until he had 3,000 hectares. By 1930, he was again one of Alberta's wealthiest farmers. But the biggest challenge was still ahead.

Noble's farm was in the parched heartland of the Alberta Dust Bowl. Long before the Depression drought hit, the farmer had recognized the dangers of wind erosion and soil drift. By 1919, years before it was com-

mon practice, he had experimented with strip cropping to reduce soil loss. He selected crops with soil conservation and drought tolerance in mind and he was an early proponent of "stubble mulching" — the practice of leaving crop residue on the fields to trap blowing soil.

Noble was an innovator, an inventor and a tireless worker. A self-trained soil scien-



Mel Crompton

existing reservoirs. Water pipelines, such as the one at New Dayton, should be constructed for both farmers and town residents when well water is inadequate, and farmers should form associations to build and operate these pipeline networks. Many rural communities need new tank loading facilities to allow farmers to haul an adequate supply of water by truck. Finally, the report says new wells and field dugouts should be developed.

The PFRA, Alberta Agriculture and Alberta Environment have already responded to the drought emergency with immediate as-



Charles Noble

tist, he filled scrapbooks with agricultural articles and made notes about new methods he had observed on his travels. He corresponded with researchers across North America. In 1932, he helped organize a farmers' conference on the dust crisis. Noble was a frequent visitor at the Lethbridge Research Station, and in the words of one superintendent, "he always brought in as many ideas as he took away."

In 1935, in the midst of agricultural chaos, Noble visited a former farm hand in

minum pipes to pump water to livestock dug-outs. Irrigation farmers use similar cumbersome pipes for water delivery to their crops.

The pipes and pumping equipment must be hauled to the installation site on long trailers. As many as five men are needed to unload the pipe and connect the 12-metre lengths on the ground — an expensive and time consuming job. Crompton is examining the advantages of a new technique which uses a flexible, plastic-lined water hose — something like a fire hose — that can be reeled out to a field

from one trailer. It is ten times as long as each aluminum pipe segment and requires less installation work and maintenance. However, it is more expensive.

Crompton is also studying new suction equipment for pumps that would allow farmers to salvage water from the shallow ditches and sloughs that criss-cross the prairie. Conventional pumping equipment can be used when the surface water source is about a metre deep. The new plumbing suction equipment needs only 20 centimetres of surface water —

on wind erosion in 1918. Investigating the problem, he soon realized little research had been conducted despite the imminent threat of a soil crisis. He became an enthusiastic advocate of "stubble mulching" at a time when the technique was unpopular with farmers. The scientist was nicknamed "Trash Cover Palmer" but it was said he knew more about soil drifting than any other Canadian.

"Palmer had the knack of not only instantly recognizing a good idea when he saw it but in seeing how it might be improved and adapted," said James Gray in his book on the Depression drought, *Men Against the Desert*. The scientist was soon convinced that the Noble blade had great potential in the battle to protect soil from excessive plowing. "He became its public relations godfather."

With Palmer's advice and encouragement, Noble modified his invention and set up an implement factory to build it. Palmer and his research colleagues sold the idea to western farmers. The new machine was to change farming practices across the North American plains, and is still in use today.

Charles Noble died in 1957. "His almost religious zeal for soil and its care made him a great Canadian," concluded his biographer, Grant MacEwan. A few years after Noble's death, the Soviet Union launched a program to increase wheat production in the arid areas of Siberia. And it came as no surprise to Palmer when the Russian officials sent a request to the factory at Nobleford, Alberta for a shipment of Noble blades.

"I can't think of two men who have had a greater impact on farm management in this century," says Dr. Wayne Lindwall, a soil scientist at the Lethbridge research station.

"Their contributions are often forgotten. They were not only inventors and builders but leaders and innovators."

— Linda Goyette

hardly more than a prairie puddle.

Alberta's biggest water consumer is the agricultural irrigation system. Experts agree the 5,000-kilometre canal system, which marks the landscape like a giant patchwork quilt, is often inefficient and wasteful. Too much of the water pumped from rivers or ground sources fails to reach the crops.

How does it disappear? Dixon Thompson, a professor in the faculty of environmental design at the University of Calgary, identifies three culprits: leaky canals, inappropriate sprinkler systems and irrigation farmers who do not use the water wisely.

Aging, earthen canals, some more than a half-century old, can drain valuable water into the ground before it ever reaches a farm. The good news is that they can be fixed; the bad news is the staggering cost. Dipping into the Heritage Fund, the Alberta government has spent \$172 million since 1971 on irrigation canal repairs and more than half the work remains to be done. This year, Alberta Agriculture has earmarked \$30 million for the Irrigation Rehabilitation Expansion Program, a five-year project.

"Practically speaking, it's almost



Asael Palmer

time, the inventor succeeded and the V-shaped Noble blade was born.

Returning to Alberta, Noble quickly showed his device to a respected local scientist, Dr. Asael Palmer. Palmer, an irrigation specialist, had joined the Lethbridge Research Station in 1921 and would later become its superintendent. A devout Mormon, he had been a farmer, a school teacher and an irrigation consultant for the CPR.

Palmer's passion for soil conservation had been sparked at a Lethbridge meeting



Walter Nemanishen

impossible to eliminate seepage altogether," says Gerhardt Hartman, an irrigation manager for the department. "But this effort is worthwhile."

Ideally, small-diameter pipelines should replace canals to deliver irrigation water without leakage or evaporation. Less farmland would be disturbed and there would be no need for bridges and culverts. But high cost makes such a network impractical. Instead, government workers are lining troublesome canals with plastic sheets, wire mesh and gravel, or reinforcing them with concrete, to pre-



Fall herbicide spraying for reduced tillage farming.

vent seepage and weed growth. Some canals have been relocated in deeper clay soil where moisture retention is better. "We know our limitations but we believe we can allow for a little expansion of the system," says Hartman.

Inefficient irrigation equipment is a big troublemaker in the fight against drought. High-pressure, centre-pivot sprinklers shoot water into the sky and "act like a great big humidifier for the province of Saskatchewan," says Thompson. The sun and wind evaporate much of the water before it can return to the soil. Thompson says short, low-pressure sprinklers would allow the water to gently fall on crops, although filters would be needed to prevent plugging with dirt and salts. Again, the solution is expensive.

Thompson's most controversial proposal to fight drought is to charge farmers for every drop of water they use. "When I first started talking about it in the late 1970s, there was an uproar," he said. "It is now generally agreed it will have to be done sooner or later." Farmers now pay a flat annual fee per acre to the irrigation districts no matter how much water they use. Thompson says he sympathizes with dryland farmers in drought country who can't pump water at any price while some irrigation farmers in the same province are wasting their supply. "An increase in local efficiency should precede big, new projects," he said. "The irrigators should have to demonstrate that there is no wastage going on, that they're using water efficiently."

Hartman disagrees with the water fee proposal. "Politically, it won't fly," he said. "If we charged a farmer a realistic portion of the water delivery cost, he'd go out of business, period."

Careful soil conservation is another weapon in the war against drought, perhaps the oldest. The objective is to maintain as much moisture in the soil for crops as possible and to prevent wind erosion. Summer fallowing — that is, leaving a field free of crops for a

period — has fallen out of favor with soil scientists for some agricultural areas. Newer methods of zero or minimum tillage, techniques which disturb the soil as little as possible, challenge tradition on the farm.

"So many farmers still think they have to cultivate their land five or six times a year," says Dr. Wayne Lindwall, a tillage specialist at the Lethbridge Research Station. "It's difficult to get the message across. You take the tractor and cultivator away from them and they don't feel like farmers."

Farmers who use minimum tillage cultivate their fields only for weed control, leaving crop stubble as a blanket to enclose the moisture. This "trash cover" also reduces erosion. With the zero tillage technique, farmers plant directly into the stubble of a previous crop and use herbicides for weed control. They make as few trips over the soil as possible.

Both methods are effective soil conservers but they have their problems. Trash cover can plug up farm equipment, so that special blades must be used. "The number one concern of the farmers is not the machinery but the cost of the herbicides," says Lindwall. "And we have to be cautious about what chemicals we use." He concedes special tillage methods require excellent farm management: "It's not for the lazy farmer. We've had many more failures than successes . . . But zero tillage has tremendous potential if we can tackle the economic concerns, particularly in the south."

Lindwall says about 48,000 hectares of Alberta farmland are now in zero tillage. Pat Rutledge, a southern rancher, told other farmers about his experiences at the Soil at Risk conference in Hanna last April: "We are convinced we are on the right track with zero till. It is not a perfect answer but the problems are solveable. Our land isn't blowing away." Another zero-tiller, Sheldon King of High River, says his herbicide costs are reduced because he buys the chemicals in bulk with a 175-member No-Till Association. "If we can

educate people about rotations and proper use of chemicals, we can accomplish a lot for soil conservation," he said. "It's a matter of change for many farmers. The change has to happen in your head before it can happen on the ground."

Other soil conservation techniques are important in the drought war. Strip cropping, for example, alternates ribbon-like fields of fallow and productive land at distances adequate to prevent soil drift. Tree shelter belts and carefully-seeded tall grasses can also reduce wind erosion. Finally, farmers can rely on a loyal, if unpleasant, winter companion: the prairie snow blizzard.

Soil experts at the Swift Current Research Station have developed several techniques to keep snow on dry fields so that it supplies water to soil in the spring. "The entire object is to leave the field as aerodynamically rough as possible," says Dr. Harold Steppuhn, a research scientist at the station. "Usually it's quite simple for the farmer."

Snow trap swathing — that is, cutting crop residue in rough patterns to trap blowing snow — is one method. Using simple attachments to harvest swathers, farmers slice the crop stubble at different heights, to create a natural barrier for snowflakes. Peaked snowdrifts are the result. Dr. David Chanasyk, a soil scientist at the University of Alberta, says the swathing technique is not widely used in this province. "One of the reasons is that many farmers cultivate in the fall to reduce the spring workload," eliminating the necessary stubble, he says. "I don't think they are convinced the technique is in itself worthwhile." But Chanasyk's research shows that a drought area farmer who keeps a careful eye on climatic conditions can use snow trap swathing to great advantage.

Steppuhn says other snow capture techniques are also useful. The lower branches of trees in a shelter belt can be pruned so that snow moves through them and spreads evenly across a field. Tall grasses can be planted in rows to trap snow.

"Most farmers have heard about snow capture by now," says Steppuhn. "It's just a question of whether it fits into their operation. Only they can decide." He concedes it is "one extra task at a busy time" but says snow capture methods are cheap and effective. "It's certainly worth it in soil moisture if the individual farmer stays with it."

The southern Alberta farmer's best ally in the fight against drought may be his crop — if he selects the right one. Drought-tolerant plants share characteristics that allow them to conserve water and tolerate long shortages. They may have deep root systems for moisture storage or waxy or hairy leaves to reduce evaporation. Norman Storch, another farmer who addressed the Soil at Risk conference in Hanna, emphasized the importance of plant selection. "I think the real secret to successful



Stubble is cut in rough patterns to trap blowing snow.

soil conservation is to find crops and cropping practices that are most compatible with soils specific to your area or farm."

Dr. John Clarke, a plant physiologist, is working with a team of scientists at the Swift Current Research Station to develop new drought-resistant varieties. He has conducted most of his research with Durham wheat, evaluating more than 4,000 different genotypes from around the world. He is especially interested in hardy plants from the Middle East and North Africa that might be crossed with a-

dapted varieties here. Pellissier wheat, which now accounts for 24 per cent of the Durham planted on the dry Alberta-Saskatchewan border, was originally developed from an Algerian variety. Dr. Clarke plans a visit to the Middle East this spring to exchange germ plasm and research ideas with international specialists in arid agriculture.

"We're not going to make Super Plants, I don't think anyone expects that," said Clarke. "But I think we can pump up overall production a significant amount."

Unfortunately, the development of drought-tolerant varieties is a slow, slow process. "It takes 15 to 16 years to develop a variety, another three years for seed companies to make it available and then it takes farmers a certain amount of time to adopt it," explains Clarke. "We are developing new varieties for the next generation, not this one."

Small-scale projects, no matter how innovative, can't win the battle against drought alone. They have economic and practical limitations. Still, viewed together, they comprise a sensible approach to an intimidating problem. The careful management of natural resources and man-made technology can only help improve the situation in drought country.

Alfred Oseen needs no convincing. He's lived 77 of his 78 years on the same parched farmland near Turin. In 1982 he helped launch the Sundial Group Project with four neighboring farmers who needed a water pipeline. With government funding, they completed the job. Oseen can't help comparing this success with his experience as a farmer during the Depression.

"We just figured we were the forgotten people. We had plenty of ideas but no money to implement them."

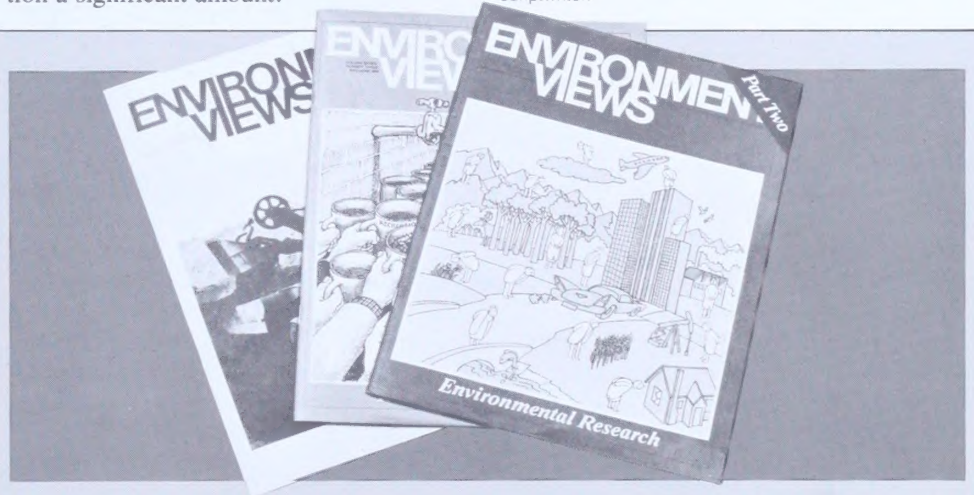
These days, he's happy to say, it's a different story.

Linda Goyette is an Edmonton freelance journalist and scriptwriter.

READERSHIP SURVEY RESULTS

You may remember that in the September 1985 issue of Environment Views we included a readership survey. We are pleased to report that we received responses from about 10 per cent of our readers. Highlights of the survey results are as follows:

- The largest group of Environment Views readers is made up of Alberta government employees who are not members of environmental organizations.
- Slightly fewer than one quarter of our readers are teachers, primarily of science or social studies. Within this category high school teachers represent the largest single group and elementary level teachers make up the smallest.
- Over three quarters of our readers read the issues "thoroughly".



- Environment Views is regularly used in schools as resource material. About one-third of our teacher-readers use it frequently, and more than half use it occasionally.
- Most of our readers consider Environment Views a good publication. They are most satisfied with its "readability" and with the "topics covered". Some readers, primarily industry workers and non-members of environmental organizations, were critical of the publication's "objectivity" and depth of coverage". Non-teachers rated Environment Views more highly in every respect than did teachers.
- Our readers' appreciation of Environ-

ment Views is indicated by their willingness to pay for this publication. Nearly two-thirds are willing to pay at least five or 10 dollars a year.

- Readers had a wide range of suggestions for topics to be covered in Environment Views. The five most popular topics were: wildlife habitat, and wildlife management; waste disposal; water and resource management; air quality; environmental impacts; and hazardous waste management.

For additional information about the readership survey, contact the editor at the address on the contents page.

If undelivered, return to:

Environment Views
Alberta Environment
9820 - 106 Street
Edmonton, Alberta T5K 2J6

Environment Update

WWF on the Canadian Prairies

The World Wildlife Fund (WWF) has committed \$600,000 over the next three years for a Canadian prairie conservation program called Wild West.

"We want to mount high-profile, high-intensity endangered-species-saving," Monte Hummel, WWF Canada's president, said in Edmonton recently. He said WWF funds would be more than matched by contributions from other agencies.

Hummel outlined plans for Wild West and unveiled a new fund-raising poster at the Endangered Species in the Prairie Provinces Workshop, held in Edmonton January 25. The workshop was attended by more than 400 biologists, naturalists, and conservationists from across Canada and the northwestern United States.

Hummel said 75 to 80 per cent of Canadian prairie ecosystems have vanished and over half the endangered species in Canada are found on the prairies.

The World Wildlife Fund will officially launch Wild West during National Wildlife Week in April with the opening of its office in one of the prairie cities.

Our Mistake

You may have been confused by apparently contradictory messages in the last issue. We warned you that it was your last chance to return the enclosed card in order to keep receiving *Environment Views*, because we were making up an all-new mailing list. Unfortunately, the card the printer bound into that issue was the old change-of-address card.

The deadline for making the new list has been extended. If you haven't got your name on the new mailing list, send in your card now, and you won't miss a single issue. We need your support to keep this publication going.



Tourism and the Environment

The Canadian Society of Environmental Biologists, Alberta Chapter, will be holding its annual symposium in Calgary, at the Calgary Convention Centre March 18 and 19. The topic is Tourism and the Environment: Conflict or Harmony? Guest speakers will include recreation, parks and tourist industry representatives from across the country.

For further information contact: Esther Kienholz, Edmonton 468-8058 or CSEB, Box 12, Substation 11, Edmonton T6G 2E0.

Recycling in Alberta

The Environment Council of Alberta has a number of background reports ready in preparation for its hearings on Recycling in Alberta to be held later this year. The reports include: *Municipal Solid Waste — Alberta's Untapped Resource?*; *Resource Recycling in Alberta*; *Garbage to Gold? Issues and Opportunities*; *Terms of Reference and Background Information*; *The Use of Municipal Waste as Fuel*; and *Economic Barriers to Recycling*. The five publications are available free on request.

Rocky Road Map

The Canadian Society of Petroleum Geologists has produced a geological road map of Alberta. Surface geological features are

shown on a base map of major highways, water bodies, cities and towns. The map also includes cross-sections of the major geological regions of the province.

It is priced at \$3, with quantity discounts available. For further information, contact John Maher, President, Canadian Society of Petroleum Geologists, in Calgary, 233-9317.

Resource Recovery Seminar

A seminar entitled *Waste — An Untapped Resource* will be offered through the University of Alberta Faculty of Extension March 20 and 21 at the U of A. The seminar will examine the present status of recycling in Alberta. It should appeal to environmental educators, waste management and resource or energy conservation professionals, recyclers and waste management operators, recycling project operators, local administrators and environmental interest groups.

If you have a short news item of province-wide interest you'd like to contribute to *Environment Update*, please send it to the editor at the address on the Contents page. The editor reserves the right to select and edit the items.